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A Review: Enhancement of Brain Computer Interface

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***Abstract*— An effective brain computer interface (BCI) leverages the separate strengths of both human and machine to create new capabilities and leaps in efficiencies. With B-Alert BCI development tools, developers are provided rapid prototyping tools to fit the right approach to the right task. Within clinical environments, the results are recovery of lost function and accelerated healing. In other applications, BCI's facilitate more efficient interactions between man and machine. The work focus on P300 (Type of EEG signal) signal processing, feature extraction from the processed signals, discovering signal classes, classification and interpretation of unknown signals.**

***Index Terms*—BCI, P300, EEG Signal, SOM**

I. INTRODUCTION

The work focus on P300 (Type of EEG signal) signal processing, feature extraction from the processed signals, discovering signal classes, classification and interpretation of unknown signals. The research methodology involves following steps:

- EEG Data Sets (Already Collected)
- Signal Preprocessing
- Feature Extraction
- Knowledge Discovery using SOM
- Classification using Classifier Ensemble
- Comparing Accuracy with already work done

a. Signal acquisition

In the BCIs discussed here, the input is EEG recorded from the scalp or the surface of the brain or neuronal activity recorded within the brain. Electrophysiological BCIs can be categorized by whether they use non-invasive (e.g. EEG) or invasive (e.g. intracortical) methodology. They can also be categorized by whether they use evoked or spontaneous inputs. Evoked inputs (e.g. EEG produced by flashing letters) result from stereotyped sensory stimulation provided by the BCI. Spontaneous inputs (e.g. EEG rhythms over sensor motor cortex) do not depend for their generation on such stimulation. There is, presumably, no reason why a BCI could not combine non-invasive and invasive methods or evoked and spontaneous inputs. In the signal-acquisition part of BCI operation, the chosen input is acquired by the recording electrodes, amplified, and digitized[15]

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b. Signal processing-

The goal of signal analysis in a BCI system is to maximize the signal-to-noise ratio (SNR) of the EEG or single-unit features that carry the user's messages and commands. To achieve this goal, consideration of the major sources of noise is essential . Noise has both non neural sources (e.g., eye movements, EMG, 60-Hz line noise) and neural sources (e.g., EEG features other than those used for communication). Noise detection and discrimination problems are greatest when the characteristics of the noise are similar in frequency, time or amplitude to those of the desired signal. For example, eye movements are of greater concern than EMG when a slow cortical potential is the BCI input feature because eye movements and slow potentials have overlapping frequency ranges.

Numerous options are available for BCI signal processing. Ultimately, they need to be compared in on-line experiments that measure speed and accuracy. The new Graz BCI system, based on Matlab and Simulink, supports rapid prototyping of various methods. Different spatial filters and spectral analysis methods can be implemented in Matlab and compared in regard to their online performance. Autoregressive (AR) model parameter estimation is a useful method for describing EEG activity.

Signal processing methods are important in BCI design, but they cannot solve every problem. While they can enhance the signal-to-noise ratio, they cannot directly address the impact of changes in the signal itself. Factors such as motivation, intention, frustration, fatigue, and learning affect the input features that the user provides. Thus, BCI development depends on appropriate management of the adaptive interactions between system and user, as well as on selection of appropriate signal processing methods[14].

c. Feature extraction

The digitized signals are then subjected to one or more of a variety of feature extraction procedures, such as spatial filtering, voltage amplitude measurements, spectral analyses, or single-neuron separation. This analysis extracts the signal features that (hopefully) encode the user's messages or commands. BCIs can use signal features that are in the time domain (e.g. evoked potential amplitudes or neuronal firing rates) or the frequency domain. A BCI could conceivably use both time domain and frequency-domain signal features, and might thereby improve performance [14].

d. The translation algorithm

The first part of signal processing simply extracts specific signal features. The next stage, the translation algorithm,

translates these signal features into device commands orders that carry out the user's intent. This algorithm might use linear methods (e.g. classical statistical analyses (Jain et al., 2000) or nonlinear methods (e.g. neural networks). Whatever its nature, each algorithm changes independent variables (i.e. signal features) into dependent variables (i.e. device control commands).

A translation algorithm is a series of computations that transforms the BCI input features derived by the signal processing stage into actual device control commands. Stated in a different way, a translation algorithm takes abstract feature vectors that reflect specific aspects of the current state of the user's EEG or single-unit activity (i.e., aspects that encode the message that the user wants to communicate) and transforms those vectors into application-dependent device commands. Different BCI's use different translation algorithms (e.g., [3]–[9]). Each algorithm can be classified in terms of three key features: transfer function, adaptive capacity, and output. The transfer function can be linear (e.g., linear discriminate analysis, linear equations) or nonlinear (e.g., neural networks). The algorithm can be adaptive or non adaptive. Adaptive algorithms can use simple handcrafted rules or more sophisticated machine-learning algorithms. The output of the algorithm may be discrete (e.g., letter selection) or continuous.[4]

e. The output device

For most current BCIs, the output device is a computer screen and the output is the selection of targets, letters, or icons presented on it. Some BCIs also provide additional, interim output, such as cursor movement toward the item prior to its selection. In addition to being the intended product of BCI operation, this output is the feedback that the brain uses to maintain and improve the accuracy and speed of communication. Initial studies are also exploring BCI control of a neuroprosthesis or thesis that provides hand closure to people with cervical spinal cord. In this prospective BCI application, the output device is the user's own hand.

f. The operating protocol

Each BCI has a protocol that guides its operation. This protocol defines how the system is turned on and off, whether communication is continuous or discontinuous, whether message transmission is triggered by the system (e.g. by the stimulus that evokes a P300) or by the user, the sequence and speed of interactions between user and system, and what feedback is provided to the user. Most

protocols used in BCI research are not completely suitable for BCI applications that serve the needs of people with disabilities. Most laboratory BCIs do not give the user on/off control: the investigator turns the system on and off. Because they need to measure communication speed and accuracy, laboratory BCIs usually tell their users what messages or commands to send. In real life the user picks the message. Such differences in protocol can complicate the transition from research to application.

A standard P300 signal Dataset that has already been collected. The BCI competitions have been used to collect the datasets of P300 signals. These signals will be pre-processed which includes amplification; filtering and then the signals are digitized for further feature extraction and classification purpose. The P300 signals are non-stationary and self-generated signals.

For better interpretation of the EEG signal in time-domain and frequency-domain simultaneously, wavelet Transform (WT) and wavelet Packet Transform (WPT) are good analysis tools. Also, the extensive research has been discussed for feature extraction in P300 based BCI systems using wavelet theory or wavelet packet decomposition. Knowledge Discovery is the process of discovering new patterns from large data sets. Here Self-organizing Feature Map will be used to discover classes from signals. The pre-processed wavelet vectors form 'clusters' on the trained SOM that are related to P300 patterns. Every detected class depicted as a cluster on the map. For the classification of the unknown data samples, various types of classifier exist. A variety of techniques exists for classification purpose like artificial neural network, Back-propagation Neural Network, Hidden Markov Model (HMM) and Bayes Network etc.

Recent work has shown that ensemble learning has employed combining classifiers. This combining classifier approach has solved the problem of reducing variance as unstable classifiers can have universally low bias and high variance. There are various ensemble learning methods, commonly used are Bagging, Boosting, Stacking and Voting. Therefore, classifier ensemble (a recent trend in classifier combination) will be used to obtain a better classification.

II. LITERATURE REVEIW

Anupama.H.S, N.K.Cauvery, Lingaraju.G.M (2012) proposed that A Brain Computer Interface (BCI) provides a communication path between human brain and the computer system. With the advancement in the areas of information technology and neurosciences, there has been a surge of interest in turning fiction into reality. The major goal of BCI research is to develop a system that allows disabled people to communicate with other persons and helps to interact with the external environments. This area includes components like, comparison of invasive and noninvasive technologies to measure brain activity, evaluation of control signals (i.e. patterns of brain activity that can be used for communication), development of algorithms for translation of brain signals into computer commands, and the development of new BCI applications. This Paper provides an insight into the aspects of BCI, its applications, recent developments and open problems in this area of research.

Jonathan R. Wolpawa, Niels Birbaumer, Dennis J. McFarlanda (2002) proposed that For many years people have speculated that electroencephalographic activity or other electrophysiological measures of brain function might provide a new non-muscular channel for sending messages and commands to the external world – a brain–computer interface (BCI). Over the past 15 years, productive BCI research programs have arisen. Encouraged by new understanding of brain function, by the advent of powerful low-cost computer equipment, and by growing recognition of the needs and potentials of people with disabilities, these programs concentrate on developing new augmentative

communication and control technology for those with severe neuromuscular disorders, such as amyotrophic lateral sclerosis, brainstem stroke, and spinal cord injury. The immediate goal is to provide these users, who may be completely paralyzed, or 'locked in', with basic communication capabilities so that they can express their wishes to caregivers or even operate word processing programs or neuroprostheses.

Brent J. Lance and Kaleb McDowell(2012) proposed that As the proliferation of technology dramatically infiltrates all aspects of modern life, in many ways the world is becoming so dynamic and complex that technological capabilities are overwhelming human capabilities to optimally interact with and leverage those technologies. Fortunately, these technological advancements have also driven an explosion of neuroscience research over the past several decades, presenting engineers with a remarkable opportunity to design and develop flexible and adaptive brain-based neurotechnologies that integrate with and capitalize on human capabilities and limitations to improve human-system interactions. Major forerunners of this conception are brain-computer interfaces (BCIs), which to this point have been largely focused on improving the quality of life for particular clinical populations and include, for example, applications for advanced communications with paralyzed or "locked-in" patients as well as the direct control of prostheses and wheelchairs.

Luis Fernando Nicolas-Alonso and Jaime Gomez-Gil (2012) proposed that a brain-computer interface (BCI) is a hardware and software communications system that permits cerebral activity alone to control computers or external devices. The immediate goal of BCI research is to provide communications capabilities to severely disabled people who are totally paralyzed or 'locked in' by neurological neuromuscular disorders, such as amyotrophic lateral sclerosis, brain stem stroke, or spinal cord injury. Here, we review the state-of-the-art of BCIs, looking at the different steps that form a standard BCI: signal acquisition, preprocessing or signal enhancement, feature extraction, classification and the control interface.

III. OBJECTIVE

- Investigate the event-related potential (ERP) response for the P300-based brain–computer interface speller.
- A signal preprocessing method integrated coherent average, principal component analysis (PCA) and independent component analysis (ICA) to reduce the dimensions and noise in the raw data.
- The time–frequency analysis will be based on wavelets.

IV. METHODOLOGY

A research methodology provides us the basic concept if other has used techniques or methods similar to the ones we are proposing, which technique is best appropriate for them and what kind of drawbacks they have faced with them. Hence, we will be in better position to select a methodology that is capable of providing a valid answer to all the research questions which constitutes research methodology. At each step of our operation we are provide d with multiple choices either to take this scenario or use any other, which will let us to define and help us to achieve objective. Thus knowledge base of research paper methodology plays an important role.

RESEARCH PLAN

The whole program is divided into 3 phases:

PHASE 1

- load the training dataset
- select the specific channel in which P300 signals are present
- lowpass and highpass butterworth filtering
- coherence averaging
- ICA
- PCA
- wavelet filtering to extract the features to be trained using db4 wavelet
- k means clustering of the obtained features
- SVM training of the clusters obtained after k means

PHASE 2

- load the testing dataset
- select the specific channel in which P300 signals are present
- low pass and high pass butter worth filtering
- coherence averaging
- ICA
- PCA
- wavelet filtering to extract the features to be trained using db4 wavelet
- k means clustering of the obtained features

PHASE 3

Classify using trained clusters from Phase 1 and features from Phase 2

V. FUTURE SCOPE

The discussed study shows that the question about the mechanisms generating the ERP in the human EEG is still far from being answered. It is noteworthy that several studies yielding evidence for phase resetting argue that phase reset may be only one mechanism which is involved in ERP generation, but they also provide evidence for an evoked response. The crucial point, is to quantify the contribution of each mechanism.

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A Compact Detector Set for Artificial Immune Systems

Nguyen Van Truong

***Abstract*— Negative selection algorithms (NSA) are methods inspired by the T cells maturating process. They all comprise of two phases: generation of detectors that match none of the self samples, and classification of monitored elements as self or nonself using these detectors. However, the detector sets generated may be redundant. In this paper, we propose a new negative selection algorithm to generate a complete and non-redundant detector sets that use an extension of r-chunk matching rule. This allows to reduces detectors storage and classification time. Experimental results on four datasets show the effective of proposed algorithm.**

***Index Terms*—Immune system, negative selection, r-chunk, detectors generation.**

I. INTRODUCTION

In the field of Artificial Immune Systems (AIS), negative selection algorithm is class of techniques inspired by the T cells maturating process that happens in thymus. The discriminating mechanism between self (signal of a healthy cell) and nonself (signal of an unhealthy cell) of T cells are modeled by NSAs. T cells are first generated randomly and in a large number, in the hope that every pathogen that might infect the host could be detected by at least some of these cells. However, the host must ensure that no cell generated would turn against itself (autoimmune reactions). Hence, newborn T cells must undergo the process of selection to ensure that they are able to recognize nonself. This process might be conducted by a negative selection: if a T cell detects any self protein, it is discarded; otherwise, it survives [4].

Given a collection of self patterns S, a typical NSA comprises of two phases: detector generation and detection [2], [12]. In the detector generation phase (Fig. 1.a), the detector candidates are generated randomly and censored by matching them against given self samples taken from the set S. The candidates that match any element of S are eliminated and the rest are kept and stored in the set D. In the detection phase (Fig. 1.b), the collection of detectors are used to distinguish self (system components) from nonself (outlier like viruses, worms, etc.). If an incoming data instance matches any detector, it is claimed as nonself, and it is claimed as self otherwise.

From a machine learning perspective, negative selection is usually described as an anomaly detection technique. Since its introduction, NSA has been a source of inspiration for many computing applications, especially for intrusion detection [4], [14], computer virus detection [9], monitoring UNIX processes [8], spam detection [18], modeling of immunological processes such as HIV infection modeling [15].

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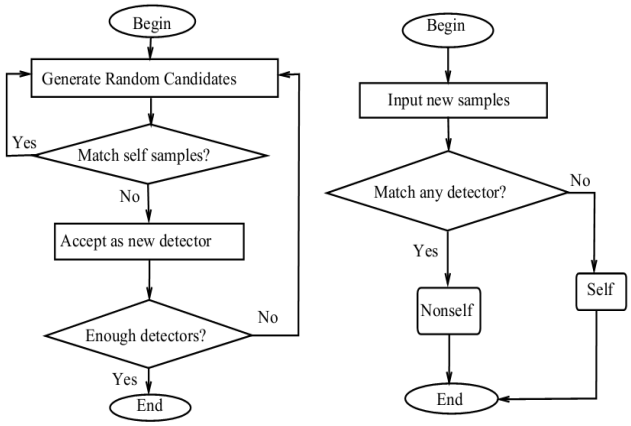

Fig. 1. Outline of a typical negative selection algorithm [13].

For binary-based AIS (i.e. the representations for cells, detectors are binary strings), r-chunk and r-contiguous bits (rcb) are two common matching rules used for the construction of detector set (and also for the detection phase). An r-chunk matching rule can be seen as a generalization of the rcb matching rule. To date, there have been some computing models of binary detectors that could generate a complete and non-redundant detector set, called perfect detector set, a set of minimum detectors with the same detection ability in comparing to that of all possible detectors, such as those based on prefix trees [5], [16], or automata [6]. In these models, detectors are represented as a whole structure (tree or automata) rather than a set of individual strings. While they provide a more compact representation of the detector sets for AIS and therefore achieve a better detection time complexity, these models of binary-based AIS are hard to deploy in distributed environments. Naturally, one desirable property of NSA is its ability to be implemented in a distributed manner - each detector might detect different kind of nonself, this is desirable for many applications such as in computer security systems. Therefore, the focus of this paper is on binary-based NSAs that employ a discrete set of detectors (strings) so that they can be implemented in distributed environments. We can, for example, randomly divide the discrete set of detectors into some subsets, each one for a nodes in in distributed environments.

With respect to binary-based AIS using discrete detector set, to the best of our knowledge, the only algorithm for generating a perfect and discrete set of r-chunk (rcb-based) detectors was proposed by T. Stibor in [21] (by S. T. Wierzchoń in ([20]), which has frequently been cited, compared, and applied in the literature with 44 (47) citations on Google Scholar. The main contribution of our paper is to design new deterministic algorithm to generate a perfect and discrete set of rcbvl-based detectors, which is equitable to a full set of r-chunk-based detectors in term of anomaly detection.

Moreover, compact string-based detectors set can achieve better memory and time complexities compared to conventional algorithms.

The rest of the paper is organized as follows. In the next section, we first present some basic terms and definitions. After the introduction of strings, two common matching rules for generating detector set, r-chunk and rcb are given. Then we introduce an r-contiguous bit matching rule with variable length (rcbvl) detectors. This new type of detector set is more compact, in bits, than one bases on original r-chunk and rcb. Prefix trees are introduced as temporary data structures for generation. Section 3 details our new NSA that can generate perfect detector sets base on rcbvl. Section 4 briefly describes our experiments in generating perfect detector sets. Section 5 concludes the paper and discuss some possible future works..

II. Basic Terms And Definitions

In NSAs, an essential component is the matching rule which determines the similarity between detectors and self samples (in the detector generation phase) and coming data instances (in the detection phase). Obviously, the matching rule is dependent on detector representation. In this paper, both self and nonself cells are represented as binary strings of fixed length. This representation is the most simple and popular representation for detectors and data in AIS, and other representations (such as real valued) could be reduced to binary [10], [13].

A. Strings

An alphabet Σ is nonempty and finite set of symbols. A string $s \in \Sigma^*$ is a sequence of symbols from Σ, and its length is denoted by $|s|$. A string is called empty string if its length equals 0. Given an index $i \in \{1,...,|s|\}$, then $s[i]$ is the symbol at position i in s. Given two indices i and j, whenever $j \geq i$, then $s[i...j]$ is the substring of s with length $j - i+1$ that starts at position i and if $j < i$, then $s[i...j]$ is the empty string. A string s' is a prefix of s if $s' = s[1...j]$, $1 \leq j \leq |s|$.

Given a string $s \in \Sigma^{\ell}$, a non-empty string d, and an index $i \in \{1,..., \ell - r + 1\}$, we say that d occurs in s at position i if $s[i...i + |d| - 1] = d$. Moreover, concatenation of two strings s and s' is s + s'.

Although our approaches can be implemented on any finite alphabet, but strings used in all examples are binary, $\Sigma = \{0,1\}$, just for easy understanding.

B. R-chunk and rcb matching rules

For binary-based AIS, the rcb and r-chunk are among the most common matching rules. Given a positive integer r, a set S of self strings of length ℓ. A detector under rcb matching rule is a string of length ℓ that does not match any $s \in S$. It is said to match another string, of the same length, if they have r consecutive matching bits in the corresponding positions. Rcb was introduced and used in many AIS projects [7], [11], [17]. An r-chunk detector is a tuple of a string of r bits and its starting position with the string that does not match any $s \in S$. An r-chunk detector (d,i) is said to match a string s if d is a prefix of $s[i..|s|]$. An r-chunk matching rule is considered as a simplification of the rcb matching rule [17]. This type of detector helps AIS to achieve better results on data where adjacent regions of the input data sequence are not necessarily semantically correlated, such as in network data packets [3]. It is noted that an r-contiguous detector [4] can be decomposed into $\ell - r + 1$ overlapping r-chunk detectors.

Example 1: Let $\ell = 6$, r = 3. Given a set of five self strings $S = \{s_1 = 010101, s_2 = 111010, s_3 = 101101, s_4 = 100011, s_5 = 010111\}$. The set of all r-chunk detectors is {(000,1), (001,1), (011,1), (110,1), (001,2), (010,2), (100,2), (111,2), (000,3), (100,3), (111,3), (000,4), (001,4), (100,4), (110,4)}. The set of all detectors under rcb matching rule is {001000, 001001, 011110, 110000, 110001}.

C. Rcbvl matching rule

Given a positive integer r, a set S of self strings of length ℓ. A triple (d,i,j) of a string $d \in \Sigma^k$, $1 \leq k \leq \ell$, an integer $i \in \{1,...,\ell-r+1\}$ and an integer $j \in \{i,...,\ell-r+1\}$ is called a negative detector under rcbvl matching rule if d does not occur in any s, $s \in S$. In another words, (d,i,j) is an rcbvl detector if there exist $j-i+1$ r-chunk detectors $(d_1, i),..., (d_{j-i+1}, j)$ that d_k, d_{k+1} are two $(r-1)$-bit overlapping strings, $k = 1,...,j-i$.

Example 2: Given ℓ, r and the set S of self strings as in Example 1. Triple (0001,1,2) is an rcbvl detector because there exist two 3-chunk detectors (000,1), (001,2) that 000 and 001 are two 2-bit overlapping strings. A perfect detector set D under rcbvl matching rule contains 5 variable length detectors {(0001,1,2), (00100,1,4), (100,4,4), (011110,1,4), (11000,1,3)}. It is a minimum detectors set (23 bits) that covers all detector space of r-chunk detectors set in Example 1 (45 bits).

D. Prefix trees

A prefix tree T is a rooted directed tree with edge labels from Σ where for all $\sigma \in \Sigma$, every node has at most one outgoing edge labeled with σ. For a string s, we write $s \in T$ if there is a path from the root of T to a leaf such that s is the concatenation of the labels on this path. This tree structure is important for generating rcbvl detectors set.

Example 3: Given ℓ, r and the set of self strings S as in Example 1, four prefix trees presenting all binary 3-chunk detectors are in Fig. 2.

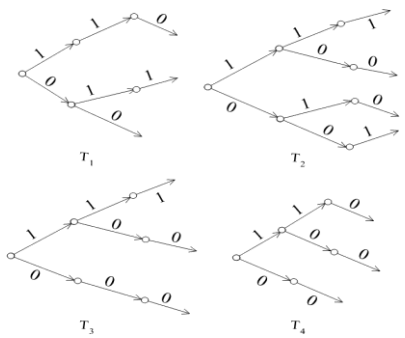

Fig.2. Trees represents 3-chunk detectors set in Example 1. Tree T_i presents 3-chunk detectors (d,i), i = 1,...,4.

III. New Negative Selection Algorithm

Given a non-empty set S of self strings of length ℓ, and an integer $r \in \{1,...,\ell - r + 1\}$, this section presents a new NSA bases on rcbvl matching rule.

A. Detectors set generation under rcbvl matching rule

Algorithm 1 Algorithm to generate perfect rcbvl detector set.

1: procedure G ENERATION D ETECTORS (S, ℓ, r, D)
2: for i = 1,...,$\ell - r + 1$ do
3: Create an empty prefix tree T_i

4: end for
5: for all s ∈ S do
6: for i = 1,...,ℓ − r + 1 do
7: insert every s[i...i + r − 1] into T_i
8: end for
9: end for
10: for i = 1,...,ℓ − r + 1 do
11: for all nonleaf node n ∈ T_i and all σ ∈ Σ do
12: if no edge with label σ starts at n then
13: create a new leaf n' and an edge (n,n') labeled with σ.
14: end if
15: end for
16: delete every node n ∈ T_i from which none of the newly created leaves is reachable.
17: end for
18: D_1 = ∅
19: D = {(s,1,1)|s ∈ T_1}
20: for i = 2,...,ℓ − r + 1 do
21: D_2 = ∅
22: for all (s,k,j) ∈ D do
23: if there exists a s' ∈ T_i where s[i−k+1...|s|] is prefix of it then
24: $D_2 = D_2 \cup \{(s+s'[|s|-j+k...|s'|],k,i)\}$
25: delete every node n ∈ T_i from which only nodes in the s' is reachable
26: for all s' ∈ T_i where s[i − k + 1...|s|] is prefix of it do
27: if |s| − i + k < r then
28: $D_2 = D_2 \cup \{(s[|s|] + s',i - 1,i)\}$
29: else
30: $D_2 = D_2 \cup \{(s',i,i)\}$
31: end if
32: delete every node n ∈ T_i from which only nodes in the s' is reachable
33: end for
34: else
35: $D_1 = D_1 \cup \{(s,k,j)\}$
36: end if
37: end for
38: for all s'∈ T_i do
39: $D_2 = D_2 \cup \{(s',i,i)\}$
40: end for
41: $D = D_2$
42: end for
43: $D = D \cup D_1$
44: end procedure

Algorithm 1 summarizes the first phase of new NSA. Some prefix trees are first used to generate perfect detectors set from S and then this set is used to distinguish if a new sample as self or nonself. In the algorithm, the process of generating We first construct for every position i ∈ {1,...,ℓ − r + 1} a prefix tree T_i . Each prefix tree T_i can be constructed as follows: start with an empty prefix tree and insert every s[i...i + r − 1], s ∈ S, into it (lines 5-9). Next, for every non-leaf node n and every σ ∈ Σ where no edge with label σ starts at n, create a new leaf n' and an edge (n,n') labeled with σ. Finally, delete every node from which none of the newly created leaves is reachable (lines 10-17). Detectors set D is first created by all s ∈ T 1 in line 19. The rest of the algorithm, lines 20-42, updates partial detectors in D by identifying their right overlapping strings in prefix trees.

From the description of the algorithm, it takes |S|.(ℓ−r+1).r steps to generate (ℓ−r+1) prefix trees and |D|.(ℓ−r+1).2^r steps to generate perfect detector set D.

Example 4: Given ℓ, r and the set of self strings S as in Example 1. Some steps in the Algorithm 1 generating a perfect detector set as in Example 2 are: Set D is first created as (00,1,1), (011,1,1), (110,1,1). Then the for loop (lines 20-42) calculates D and D_1 as following:

For i = 2: D = (0001,1,2); (0010,1,2); (0111,1,2); (1100,1,2) and D_1 = ∅. For i = 3: D = (00100,1,3); (01111,1,3); (11000,1,3) and D_1 = (0001,1,2). For i = 4: D = (00100,1,4); (011110,1,4) and D_1 = (0001,1,2); (11000,1,3); (100,4,4). The final step, $D = D \cup D_1$ in line 43, generates the perfect detector set {(0001,1,2), (00100,1,4), (100,4,4), (011110,1,4), (11000,1,3)}.

B. Detection under Rcbvl matching rule

To detect if a given string s is self or nonself, we simply check our Rcbvl matching rule on s against every detector in D. If it is the case, output s is nonself, otherwise s is self. The function min used in Algorithm 2 to return the smallest number from two values. It is easy to see that this algorithm has the same time complexity with Algorithm 1.

Algorithm 2 Algorithm to detect if a given string s is self or nonself.

1: procedure DETECTION (s, ℓ, r, D)
2: for all (s',n,m) ∈ D do
3: for i = n,...,m do
4: if s'[i...min(i + r − 1,|s'|)] occurs in s at position i then
5: output s is nonself
6: exit procedure
7: end if
8: end for
9: end for
10: output s is self
11: end procedure

IV. EXPERIMENTS

We use a popular flow-based datasets NetFlow [19] and a random dataset for experiments. The flow-based NetFlow is generated from packet-based DARPA dataset [1] is used for experiment 1. This dataset focuses only on flows to a specific port and a IP address which receives the most number of attacks. It contains all 129,571 traffics (including attacks) to and from victims. Each flow in the datasets has 10 fields: Source IP, Dest. IP, Source Port, Dest. Port, Packets, Octets, Start Time, End Time, Flags, and Proto. Similar to the previous studies [19], we select the same 4 features Packets, Octets, Duration and Flags from the NetFlow dataset as the input of two experiments in case study 1. A randomly created dataset is used for experiments in case study 2. This dataset contains 50,000 binary string with the length of 30.

Flows in NetFlow are converted into binary strings by two steps. The first step is to map all features to binary string features. After this step, a total string features are constructed for both normal data and anomalous one. The second step is to concatenate the binary string features for every flows. After this step, dataset contains binary strings with their length of 49. The distributions of training and testing datasets as well as parameters r, ℓ for 4 experiments are described in Table 1.

Table1. Data and parameters distribution for experiments and result comparison.

ℓ	r	Train	Test	Size (bit)		Time (mil. Sec.)	
				r-chunk	rcbvl	r-chunk	rcbvl
Case 1							
49	10	119571	10000	206810	42704	58962	11960
49	8	79571	50000	31672	8096	48952	11085
Case 2							
30	12	25000	25000	367092	79222	243979	44995
30	14	40000	10000	2324056	392815	518999	82922

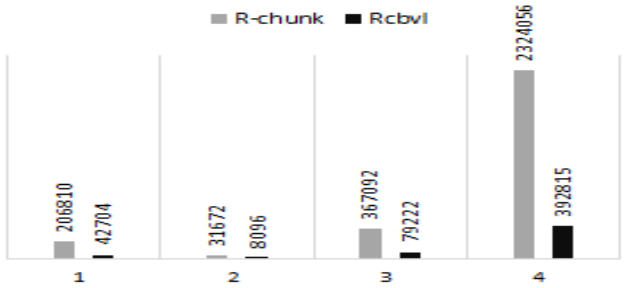

Fig. 3. Size of detectors comparisons

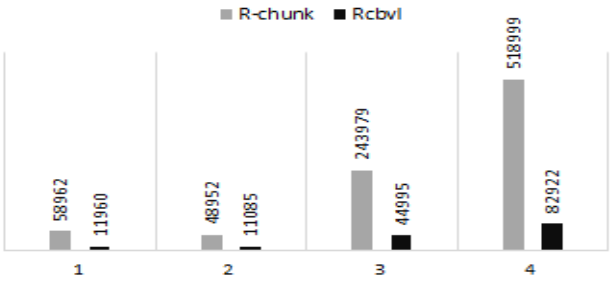

Fig. 4. Classification time comparisons

Results in Table 1 show that our proposed algorithm reduce both size (bits) of detectors and time (milliseconds) to classify testing dataset. The comparisons of detection time and detectors' size are illustrated in Fig. 3 and Fig. 4, respectively.

V. Conclusion

In this paper, we have proposed a novel NSA to generate perfect detector sets for string-based AIS. We developed a rcbvl matching rule as an extension of traditional rcb. Our new algorithm has a polynomial time complexity. More importantly, proposed algorithm always generate complete and non-redundant detector sets for string-based AIS. Experiment results show that proposed algorithm can reduce both detection phase time complexity and storage of detectors. Moreover, the varying length of the parameter r in the rcbvl matching rule can balance specialization and generalization in classification systems, which will be the next step of our study. How to apply the algorithm to intrusion detection systems would be our interesting research direction.

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Structural Analysis and Progressive Failure Analysis of Laminated Composite Joints-Single Pin Configuration

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***Abstract*—A composite material is prepared by joining two or more materials of different properties. The joined materials work together and give a new material with unique properties. Use of composite is provoked by low weight- to- stiffness and weight- to- strength ratios. Complex damage behaviour is shown by composites due to their anisotropic nature and heterogeneity. Thus the detailed analysis of composite structures is a formidable task. A joint is a structural connection between two or more members intended for load transfer. Most structures contain one or more joints. All structures contain joints. Joints are one of the greatest challenges in the design composite structures because of their anisotropic nature and heterogeneity, introduce high local stress concentrations. Damage initiation and propagation is the greatest concern in understanding the behaviour of bolted connections in composites. To support laboratory tests, a finite element modelling can be done to support joint design and predict propagation of damage. In this present study the analysis of a double lap joints are done using continuum shell elements and a progressive failure analysis was done using Tsai-Hill failure criteria and material stiffness degradation mechanism. . Progressive failure analysis was also done to determine the mode of failure and showed good correlation with the stress results. Primarily two modes of failure observed i.e. fibre failure and matrix failure.**

***Index Terms*—Composite, anisotropic, progressive failure analysis, mode of failure.**

I. INTRODUCTION

A composite material is prepared by joining two or more materials of different properties. Use of composite is provoked by high specific stiffness and high specific strength [1]. Improved weight savings, increased fuel efficiency, enhanced durability, and superior structural proper-ties make composite materials ideal for aerospace applications [2]. From the library of elements available composites can be modeled using shell elements, continuum shell elements and solid elements [3].

A joint is a structural connection between two or more members intended for load transfer. All structures contain joints. Joints are one of the greatest challenges in the design composite structures because of their anisotropic nature and heterogeneity, introduce high local stress concentrations. Thus overall structural capacity is determined by the joints.

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Several researchers have done studies on the strength of single lap composite bolted joints [4-6]. Effect of bolt-hole clearance was investigated on single-lap, single-bolt composite joints. Increasing clearance was found to result in reduced joint stiffness and increased ultimate strain in all tested configurations. In single-lap joints, clearance caused three-dimensional variations in the stress distribution in the laminate. These variations dependent on the lay-up sequence. A highly efficient user-defined finite element model and empirical expressions were developed to determine the bolt-load distribution in large-scale composite structures [7, 8].

Damage initiation and propagation is the greatest concern in understanding the behavior of bolted connections in composites. To support laboratory tests, a finite element modeling can be done to support joint design and predict propagation of damage. Failure modes and trends in material response evaluated to assess the progression of failure in composite joints. Various progressive damage mechanisms are a) continuum damage mechanics (CDM) or material properties/stiffness degradation method (MPDM) all forms of damage is represented as local stiffness reduction in individual elements. Poisson's ratios are not degraded and only the Young's moduli and shear modulus are modified for a failed element. b) Discrete damage modeling (DDM) in which matrix cracks and delamination are explicitly introduced into model as displacement discontinuities, which they create. c) X-FEM formulations, degrees of freedom are added to elements along the crack surface to describe the displacement discontinuity. d) Cohesive elements or the element failure method (EFM) model formulation was used for crack opening [9, 10]. Prediction of the failure carried out using various failure criteria such as Hashin S, Tsai-Hill and Tsai-Wu failure theory. The results obtained were compared and plotted against some available experimental findings [11,13].

In this present study, validation procedure was carried out to determine the accuracy of SC8R continuum shell elements and to verify the modeling strategy. The analysis of a double lap joints were carried out using continuum shell elements and a progressive failure analysis was done using Tsai-Hill failure criteria and material stiffness degradation mechanism.

II. FAILURE CRITERIA

A successful design requires efficient and safe use of materials. Composite materials have many mechanical characteristics that are different from those of more conventional engineering materials. Composite materials are inhomogeneous (i.e. constitute non-uniform properties over the body) and non-isotropic (orthotropic or more generally

anisotropic). An orthotropic body has material properties that are different in three mutually perpendicular directions. Have three mutually perpendicular planes of material property symmetry. Thus the properties depend on orientation at a point in the body. Isotropic materials mainly have two strength parameters such as normal strength and shear strength. Failure is initiated for an isotropic material if any of the parameters is greater than the corresponding ultimate strengths.

Theories were developed to compare the state of stress in a material to failure criteria. The two failure theories used are Tsai–Hill Failure Theory and Tsai–Wu Failure Theory, in which the strength parameters (Xt, Yt, Xc, Yc and S) are determined through experiments and stress induced (S11, S22 and S12) are results obtained from Finite element (FE) model.

Xt –Tensile strength in X direction
Yt – Tensile strength in Y direction
Xc- Compressive strength in X direction
Yc- Compressive strength in Y direction
S- Shear strength
S11- Stress induced in principal direction
S22-Stress induced in transverse direction
S12-Shear stress induced

a) Tsai–Hill Failure Theory

$$I_F = \frac{S_{11}^2}{X^2} - \frac{S_{11}S_{22}}{X^2} + \frac{S_{22}^2}{Y^2} + \frac{S_{12}^2}{S^2} \quad (1)$$

If I_F >1, failure have occurred.

b) Tsai–Wu Failure Theory

$$I_F = F_1S_{11} + F_2S_{22} + F_{11}S_{11}^2 + F_{22}S_{22}^2 + F_{66}S_{12}^2 + 2F_{12}S_{11}S_{22} \quad (2)$$

If I_F >1, failure have occurred.

Where,

$$F_1 = \frac{1}{X_t} + \frac{1}{X_c} \qquad F_2 = \frac{1}{Y_t} + \frac{1}{Y_c}$$

$$F_{11} = \frac{1}{X_tX_c} \qquad F_{22} = \frac{1}{Y_tY_c}$$

$$F_{66} = \frac{1}{S^2} \qquad F_{12} = {}^*f\sqrt{F_{11}F_{22}}$$

*f – constant default value is zero

III. Model Configuration

In this configuration the width of the composite plate is changed and the effect of change in width is been investigated. The plate is subjected to a load of 14 kN. The centre to centre distance between bolts is taken as 100mm and the edge distance is 15mm as shown in Figure 1. The diameter of bolt is 10mm. The widths of the composite plate are 50mm, 40mm, 35mm, 20mm and 15mm.

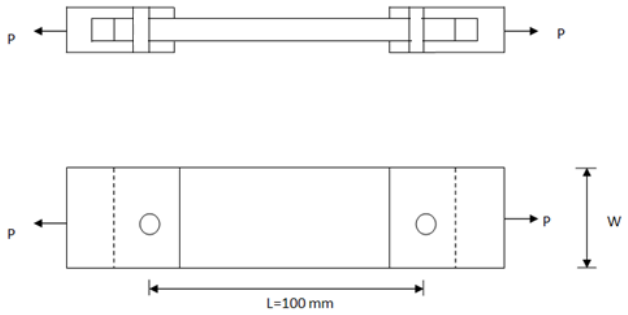


Fig. 1. Configuration

A. Material Properties

The materials used for the composite laminate are carbon -epoxy, Glass- epoxy and steel. The material properties are shown in the Table 1 and Table 2.

Table 1. Normalized material properties of carbon -epoxy and Glass epoxy

Property	Carbon-epoxy	Glass-epoxy
E_L/E_T	16.63	2.47
ν_{LT}	0.31	.229
G_{LT}/E_T	0.67	0.25
X_L/X_T	2.03	1.70
Y_L/X_T	0.04	0.3
Y_T/X_T	0.09	0.45

Table 2. Material properties of steel

Property	Steel
E_L (MPa)	200000
ν_{LT}	.31

B. Composite layup configuration

The total thickness of the composite layup is 4mm and the layup sequence is as shown in the Table 3. The composite plate is symmetric about mid layer thus only half thickness is been considered for analysis. Continuum shell elements are used to mesh a composite layup. Figure 2 shows the ply stack diagram of composite plate. Figure 3 shows the orientation of ply with respect to loading direction.

Layup Sequence is: [90/0/-45 /45/0/90/0- $G^{-1/2}$]s

Table 3. Layup configuration of composite plate

Layer No.	Material	Thickness (mm)	Fiber orientation (degree)
1	Carbon– epoxy	0.3	90
2	Carbon– epoxy	0.3	0
3	Carbon– epoxy	0.3	-45
4	Carbon– epoxy	0.3	45
5	Carbon– epoxy	0.3	0
6	Carbon– epoxy	0.3	90
7	Glass – epoxy	0.3	0
8	Carbon– epoxy	0.3	90
9	Carbon– epoxy	0.3	0
10	Carbon– epoxy	0.3	45
11	Carbon– epoxy	0.3	-45
12	Carbon– epoxy	0.3	0
13	Carbon– epoxy	0.3	90

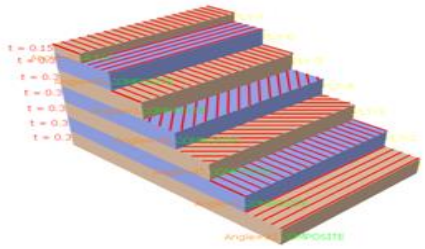


Fig. 2. Ply stack plot of composite plate.

Fig. 3. Orientation of ply with respect to loading direction

IV. Progressive Failure Analysis

Failure of composite structures is a progressive series of events. It often starts as a tiny crack between the fibres and matrix. These cracks reduce the stiffness of the composite. Capturing stress redistribution is the key to realistic simulation of failure in composite structures. Progressive failure analysis is done on the same configuration at failure load. Progressive failure analysis helps us in knowing the mode of failure. The damage in composite structures is generally a combination of matrix cracking, fibre breakage in tension and compression, and delamination. The first two damage modes, matrix cracking and fibre breakage in tension and compression are considered.

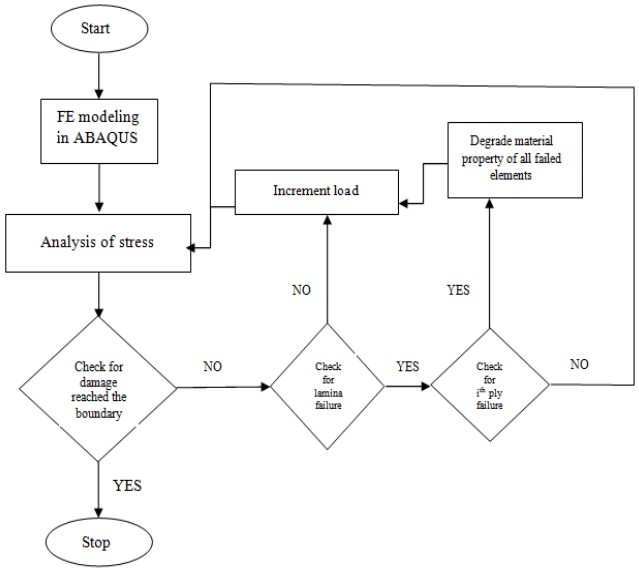


Fig. 4. Flow chart showing process of progressive failure analysis

The procedures for predicting the growth of the damage path are developed using the progressive failure analysis methodology implemented within finite element analysis. The progressive failure analysis methodology generally consists of three steps Figure 4 shows the flow chart of methodology of progressive failure analysis: a) calculating the lamina stress {Stresses computed in principal, transverse and shear directions} b) Estimating failure index and c) degrading the material stiffness in the failed elements to represent damage. In the study intra-laminar failure modes considered. Geometric and material nonlinearity were included in the model. The third and final step in the progressive failure analysis is to apply the material degradation model to the failed material points. The material properties are degraded based upon the damage mode. The progressive failure analysis is implemented in Abaqus. The process is invoked at each material point of an element to evaluate the failure criterion. When failure is detected, the degradation model is applied accordingly. In this model, the material stiffness E_{11}, E_{22} and G_{12} are instantaneously reduced by 1000.

V. Modeling

The FEM model is as shown in the Figure 5. The model has symmetry about X, Y and Z direction, thus only 1/8th of the configuration is analysed. The Figure 6 shows the meshed model configuration used for analysis in abaqus software.

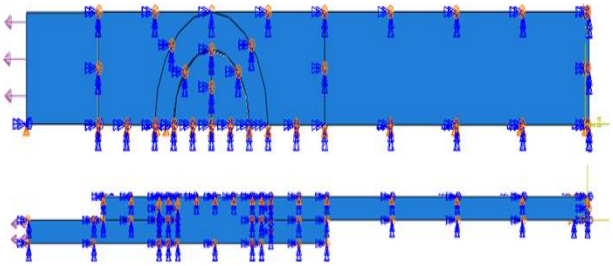


Fig. 5. Configuration model in abaqus

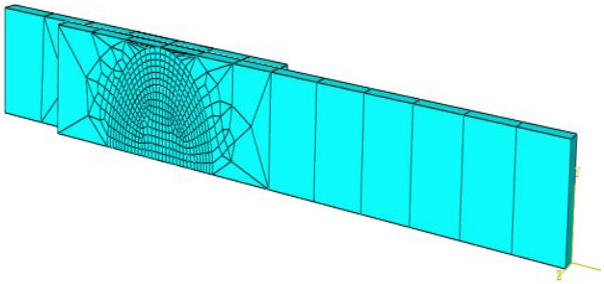


Fig. 6. Configuration meshed model in abaqus

VI. Results

A. Validation

The accuracy of any FE model is dependent on the accuracy of the geometry, the type and number of elements used, and the material property model. Validation is done in this study to check whether the SC8R elements used produce required results for the composite layup and to check the modeling strategy. For that purpose a problem done by Buket Okutan [14] is selected and FE modeling was carried out. The results are verified with the results obtained from previous study.

Geometry: A rectangular composite plate has length L, thickness t and width W with a hole of diameter D. The hole is at a distance E from the free edge of the plate . The configuration of composite plate is shown in Figure 7. In the study [14] it was observed that for the [0/90/0]s laminate, failure modes were found as bearing mode when the E/D ratio is greater than 3. Thus E/D ratio 4 was taken for validation purpose.

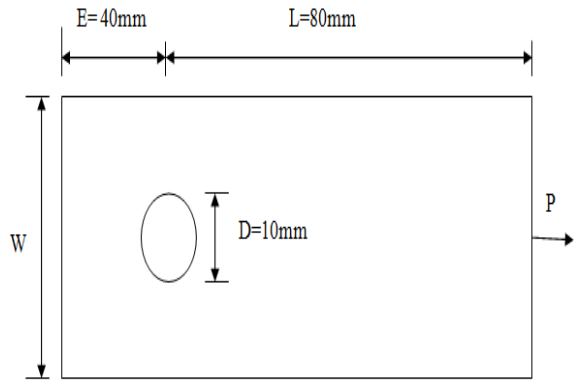


Fig. 7. Geometry of specimen

Material: Table 4 shows the material properties of glass-fiber/epoxy composite. Stacking sequence of composite plate is [0/90/0] s

Load: A tensile load is applied at the hole free edge of the plate resisted by the pin.

FE model and boundary condition: Thus composite plate modeled using abaqus software gives required results. Composite plate was modeled using continuum shell element (SC8R). Widths modeled are 20mm, 30mm, 40mm and 50mm. Figure 8. shows FE model done for the joint configuration. 1/4th of configuration was modeled due to symmetry in Y and Z direction. Symmetric boundary conditions was been applied. Tensile load is applied at the hole free end of composite. In the problem pin was assumed to be rigid and thus not modelled. The degrees of freedom were arrested in the quarter portion of bolt hole to simulate support conditions.

Table 4 Properties of glass-fiber/epoxy composite

Longitudinal modulus E1 (MPa)	44,000 (±560)
Transverse modulus E2 (MPa)	10,500 (±420)
Shear modulus G12 (MPa)	388045 (±360)
Poisson's ratio ν_{12}	0.36
Longitudinal tension Xt (MPa)	800 (±59)
Longitudinal compression Xc (MPa)	350 (±42)
Transverse tension Yt (MPa)	50 (±4.35)
Transverse compression Yc (MPa)	125 (±9.34)
Shear strength S (MPa)	120 (±15.28)

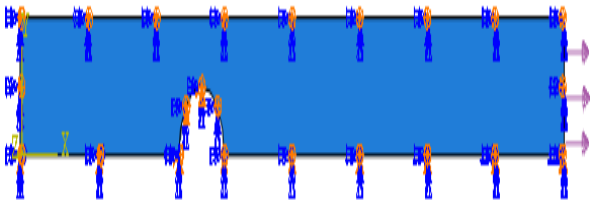


Fig. 8. FE model done for the joint configuration

Results: The obtained results (Figure 9) showed the variation of bearing strength with w/d ratio The results show good correlation and thus the results obtained are validated. Thus SC8R elements can be used to model the composite layup. In the present study bolts are also modeled to replicate the contact property in the real problem.

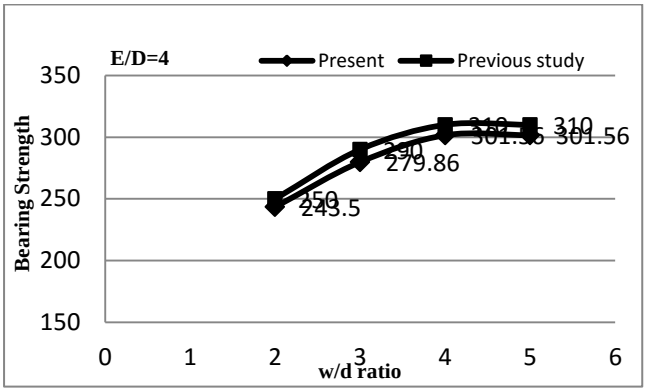
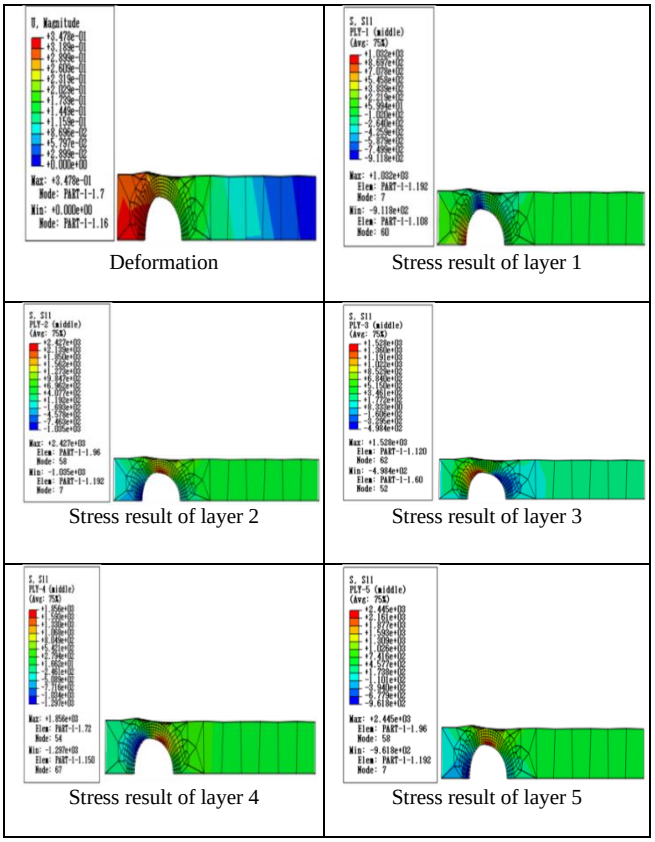


Fig. 9. Variation of bearing strength with w/d ratio

The FEM model is as shown in the Figure 5. The model has symmetry about X, Y and Z direction, thus only 1/8th of the configuration is analysed. The Figure 6 shows the meshed model configuration used for analysis in abaqus software.

B. Stress Results

Figure 10 shows S11 stress distribution in each layer of composite layup of single pin configuration of width 15mm. It can be seen from Figure 10 that, stress is concentrated at the bolt hole. Thus the circumference of bolt hole is set as the region of interest. The Figure 11-Figure 13 shows the variation of stress, i.e. S11, S22 and S12 around the bolt hole in each layer of the composite plate. The S11, S22, S12 stresses are evaluated and are used for the calculation of failure index. Tsai Hill (TSAIH) and Tsai Wu (TSAIW) failure criterion is used to determine the failure index of each layer and the layer in which first failure (first ply failure) occurred is determined. The component that is responsible and the failure load are also determined. Table 5 & Table 6 shows the failure assessment details using Tsai-Hill and Tsai-Wu failure theories.



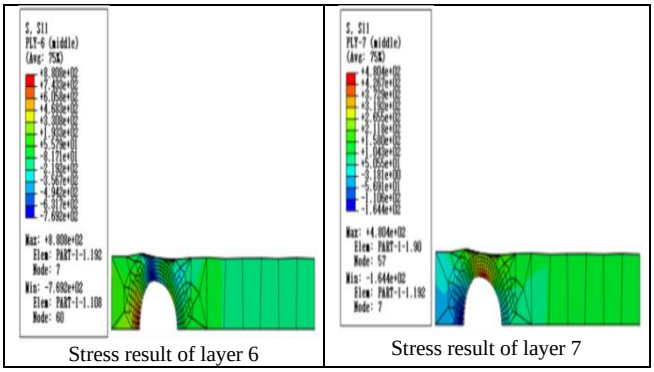


Fig. 10. Stress S11 in each layer of 15mm configuration

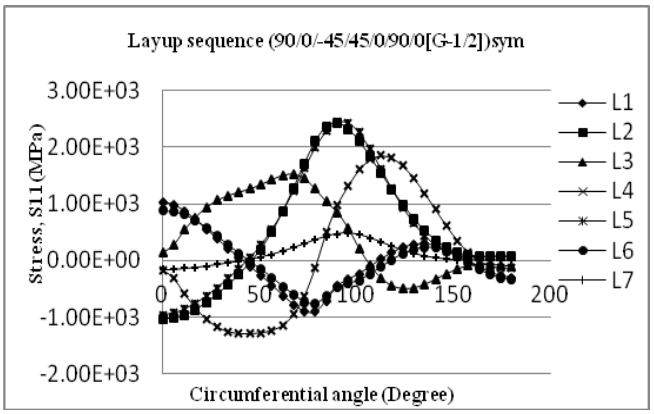


Fig. 11. Variation of stress S11 around the bolt hole in each layer of the composite plate for single pin configuration

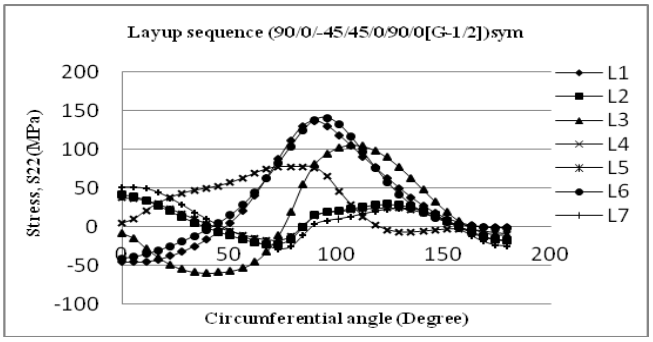


Fig. 12. Variation of stress S22 around the bolt hole in each layer of the composite plate for single pin configuration

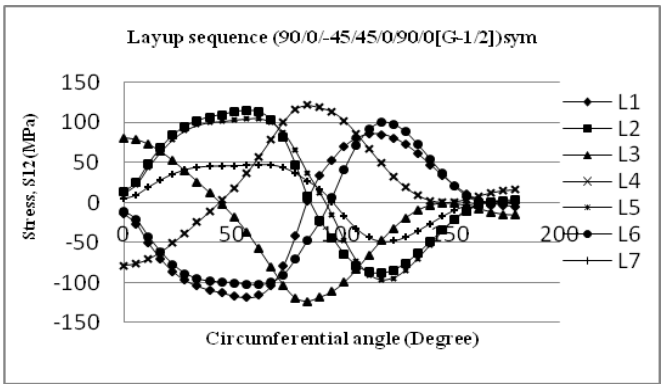


Fig. 13. Variation of stress S12 around the bolt hole in each layer of the composite plate for single pin configuration

Table 5. Failure assessment details of configuration by Tsai-Hill failure criteria

Width (mm)	Load (kN)	Tsai Hill failure index	Initial Failure layer Number	Initial Failure layer orientation	Location of failure with respect to circumference angle (degree)	Failure component
15	3.5	3.286	6	90	95.58	S22
20	3.5	2.161	6	90	95.58	S22
35	3.5	1.740	4	45	52.23	S11
40	3.5	1.726	4	45	52.23	S11
50	3.5	1.72	4	45	52.23	S11

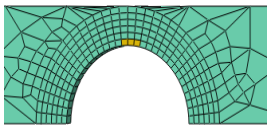
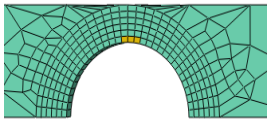
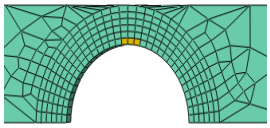
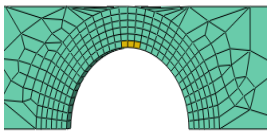
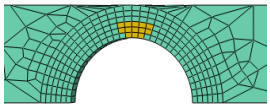
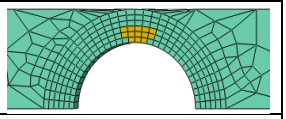
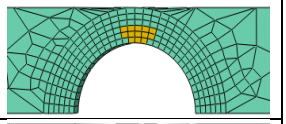
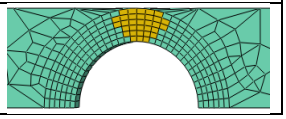
Table 6. Failure assessment details of configuration by Tsai-Wu failure criteria

Width (mm)	Load (kN)	Tsai Wu failure index	Initial Failure layer Number	Initial Failure layer orientation	Location of failure with respect to circumference angle (degree)	Failure component
15	3.5	3.421	6	90	95.58	S22-square
20	3.5	2.270	6	90	95.58	S22-square
35	3.5	1.991	4	45	52.23	S11-square
40	3.5	1.972	4	45	52.23	S11-square
50	3.5	1.971	4	45	52.23	S11-square

C. Progressive Failure Analysis

a) 15 mm width

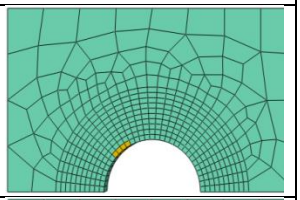
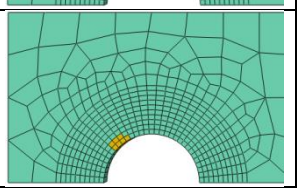
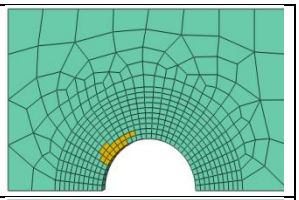
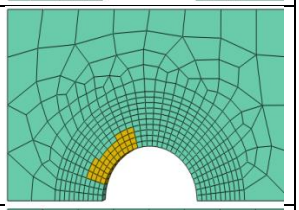
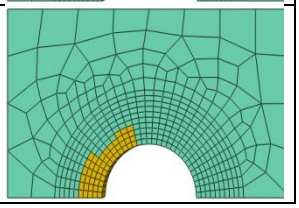
Table 7. Progressive failure analysis of configuration 15mm

No	Failure load (kN)	Layer failing Sequence	Figure
1	1.095	L6,L1	
2	1.095	L6,L1,L3	
3	1.095	L6,L1,L3, L4	
4	1.095	L6,L1,L3,L4 ,L5,L2	
5	1.095	L6,L1,L3,L4 ,L5,L2,L7	
6	1.095	L6,L1,L3,L4 ,L5,L2,L7	
7	1.095	L6,L1,L3,L4 ,L5,L2,L7	
8	1.095	L6,L1,L3,L4 ,L5,L2,L7	

Failure of laminate is assumed to occur when the element degradation reached up to the plate edge. Progressive failure analysis results of 20mm configuration are similar to Table 7.

b) 35mm width

Table 8 Progressive failure analysis of configuration 35 mm

No	Failure load (kN)	Layer failing Sequence	Figure
1	2.03	L4	
2	2.03	L4,L1,L2,L5 ,L6	
3	2.03	L4,L1,L2,L5 ,L6, L3,L7	
4	2.03	L4,L1,L2,L5 ,L6, L3,L7	
5	2.03	L4,L1,L2,L5 ,L6, L3,L7	

Failure of laminate is assumed to occur when the element degradation reached up to maximum displacement limit. Similar failure results Table 8. are obtained for 40mm and 50mm configurations.

VII. INFERENCES

- The stresses are concentrated at bolt-hole regions.
- The location of maximum stress concentration depends on the fibre orientation of each layer.
- The stress plot around the circumference of hole follows a particular trend for a fibre orientation.
- The stress concentration is larger for carbon epoxy layer than glass epoxy layer.

Table 9 describes the mode of failure of composites. There are two modes of failure mainly fibre failure and matrix failure.

Table 9 Mechanics of failure of composites

	Stress component	Mode of failure
1	S11	Fibre failure
2	S22	Matrix failure

Table 10 shows the summary of progressive failure analysis. Figure 14. variation of failure load with width.

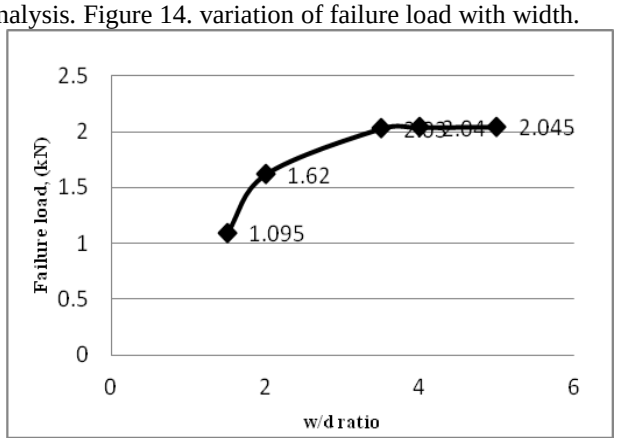


Fig. 14. Variation of failure load and width of configuration

Table 10. Summary of analysis of Single pin configuration

Width (mm)	Failure Load (kN)	Initial Failure layer No:	Initial Failure layer orientation	Location of failure with respect to circumference angle (degree)	Failure type	REMARK
1.5	1.095	6	90	95.58	Tensile Failure	S22 stress is Tensile
2.0	1.62	6	90	95.58	Tensile Failure	S22 stress is Tensile
3.5	2.03	4	45	52.23	Bearing Failure	S11 stress is compressive
4.0	2.04	4	45	52.23	Bearing Failure	S11 stress is compressive
5.0	2.045	4	45	52.23	Bearing Failure	S11 stress is compressive

VIII. CONCLUSION

The use of composites in load bearing structures is primarily motivated by high specific stiffness and high specific strength. The stress distribution depends on the layup sequence and materials used. First ply failure occurs when the first ply or ply group fails in a multidirectional laminate. Progressive failure analysis was carried out to determine the mode of failure and showed good correlation with the stress results.

- The stresses are concentrated at bolt-hole regions.
- The stress concentration is larger for carbon epoxy layer than glass epoxy layer.
- Modes of failure considered are fibre failure and matrix failure.
- When, $w/d \leq 2$: Failure type is tensile failure
- When, $w/d > 2$: Failure type is Bearing failure
- Failure load increases as the width of plate increased.

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Analyzing Online Products Based on Opinion Mining Algorithm and Semantic Keyword Analysis

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***Abstract*— Now-a-days online shopping have become a popular shopping method ever since the internet has declared a takeover. There are many individuals that are looking for other trendy shopping and online shipping is just the fix for that. This is the reason why online stores are a grooming business today. Online shopping includes buying clothes, gadgets, shoes, appliance, or even every day groceries. Online shopping is a way of best transaction between money and goods which is done by end user without spending a huge time. Every product on online shopping website is associated with reviews which represents quality of that specific product. For every purchasing the consumers are purchasing the product online by reading the product review. But reading all these customer reviews before buying product, consumes more time. Hence to overcome from this issue we propose opinion Mining algorithm and semantic analysis technique. But major issues arise when there is assignment of fake review given by unidentified user. So this system will provide methodology which will allow only those customers to give review who have purchased product from that website. Others users are not allowed to give review. This will decrease the wrong reviewing of product and customer will get reliable product.**

***Index Terms*— Opinion Mining Algorithm, Fake Reviews, Sentimental keyword analysis.**

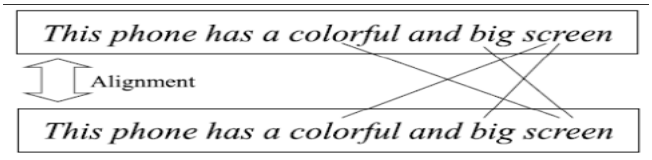
I. INTRODUCTION

A huge number of product reviews are springing up on the Internet. From these reviews, customers can obtain first-hand assessments of product information and supervision of their purchase actions. Meanwhile, manufacturers can obtain immediate feedback and opportunities to improve the quality of their products in a latest fashion. Thus, mining opinions from online reviews has become an increasing urgent activity and has attracted a great deal. Customer shopping was a concept in which a customer used to buy a product from a mall or from shop. And customers were paying money to supplier at the time of shopping (purchasing). For traditional shopping, customer needs to be directly present at shopping place. Also there was no customer review system available to describe the quality of product. Customer used to buy product on the basis of retailers opinion or suggestion. Sometimes lots of retailers give fake feedback to sell their product. But Now-a-days internet has done massive amount of evolution in shopping. Every activity is getting associated with internet.

While online shopping customer can buy their needed products by sitting at home and using smart phones, laptops, computers etc. Here user is doing online payment by means of credit card or net banking systems. There is no need of customer to be physically gone to shop or at mall for purchasing product and paying money. For choosing good quality products, online shopping provides review of each and every product given by various purchased customers. Normally all customer refers these reviews before buying any product. But customers needs more time to read each and every review of the particular product given by the other purchased customers and then take decision for purchasing product or not. As some reviews are maybe positive (good) and negative (bad) so customer has to examine each and every review before choosing that product. So we have proposed a new algorithm to guide customer for choosing a best one products. Here we are going to shortlist the positive reviews of particular product by using opinion mining algorithm.

Another problem arises when there is allocation of false review to any product. For example, if one mobile phone is available for selling on two different major e shopping website like X and Z. The Z website can give fake negative (bad) feedback (Review) to the phone selling at website X due to which purchaser will reject that phone although it is having good quality Specifications. To avoid this problem we are going to design the mechanism which will accept the review only from those customers who really have brought that product this processed based on customer purchase bill number. This will minimize fake reviewing of products done by challengers.

To overcome from the above problem we implement the opinion mining algorithm. Opinion mining is the algorithm of determining the approach of the customer with respect to the product. In general opinion of the user is most important for all organization or to individuals to improve the performance of the service. So opinion mining is the algorithm to extract (mining) the information about particular things based upon the customer reviews. The opinion mining is very interesting and important area of research due to the rising web technology. The machine learning is used to classify the user opinion text. In the section there are different types of machine learning techniques. They are opinion mining and sentimental keyword analysis.



II. BACKGROUND AND RELATED WORK

A. Opinion Mining of Movie Review using Hybrid Method of Support Vector Machine and Particle Swarm Optimization:

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Day-to-day, online social media is online discourse where people contribute to create content, share it, bookmark it, and network at an impressive rate. The faster communication and ease of use in social media today is Twitter. The messages on Twitter include reviews and opinions on certain topic such as movie, book, product, politic, and so on. Based on this situation, this research attempts to use the messages of twitter to review a movie by using opinion mining or sentiment keyword analysis. Opinion mining refers to the application of natural language processing, computational linguistics, and text mining to classify whether the film is good or not based on message opinion. Support Vector Machine (SVM) is manage the learning methods that examine data and recognize the patterns that are used for classification. This research concern on binary classification which is classified into two classes. Those classes are positive and negative. The positive (+ve) class shows good message opinion; otherwise the negative class shows the bad message opinion of certain films. This justification is based on the accuracy level of SVM with the validation process uses 10-Fold cross verification and confusion matrix. The hybrid Partial Swarm Optimization (PSO) is used to improve the election of best parameter in order to resolve the dual optimization problem. The result shows the improvement of accuracy level from 71.87% to 77%.

B. Web product ranking using opinion mining:

Online shopping is becoming increasingly important as more manufacturers sell products on the online shopping, and many users are using the Internet to communicate and share their opinions. However, it is impossible and difficult for consumers to read all product reviews. Therefore, it is essential to design effective systems to review the pros and cons of product characteristics, so that user can quickly find their favorable products. In this project, we present a product ranking system using opinion mining Algorithm. Users can specify product features to view the ranking results of all matched products. In this system, we consider three issues while analysis product scores: 1) product reviews, 2) product popularity, and 3) product release month. Finally, the experimental results execute that the system is practical and the ranking results are interesting.

C. Opinion Mining Using Frequent Pattern Growth Method from Unstructured Text:

In the last decade, the area of opinion mining has experienced a major expansion because of the increase in online unstructured data which are contributed by reviewers over various different topics and subjects. These data sometimes become important and need for users who want to take their decision based on user opinions of actual customer of the product. In this paper, we present the FP-growth method is used for frequent pattern mining from review documents which act as a spine for mining the opinion words along with their applicable features by experimental data over from two different domains which are very different in their nature.

D. Opinion Mining on Social Media Data:

Micro blogging (Social Media) has become a very popular communication tool among online users in recent years. Information is generated and managed through either via computer or mobile devices by single person and is consumed by many other persons, with most of this customer-generated content being textual information. However this trouble is challenging because a micro-blog post is usually very short and colloquial and oldest opinion mining algorithms do not perform well. Therefore, in this paper, we propose a new system architecture that can mechanically analyze the sentiments of these messages. We combine this system with manually annotated data from Social media, for the task of sentiment analysis. In this system, machines can learn how to automatically extract the set of customer messages (data) which contain opinions, filter out non opinion messages and conclude their sentiment. Experimental results confirm the effectiveness of our system on sentiment analysis in real micro blogging applications.

III. ALGORITHMS

TEXT MINING ALGORITHM

Text mining is the study of data contained in natural language text. The application of text mining techniques to solve business difficulty is called text analytics. Text mining can help an organization to derive potentially valuable business insight from text-based content such as word documents, email and postings on social media streams like FB, Twitter and LinkedIn. Mining unstructured data through natural language processing (NLP), statistical modeling (SM) and machine learning techniques (MLT) can be challenging, because natural language text is often inconsistent. It contains ambiguity caused by contradictory syntax and semantics, including slang, language specific to vertical industries and age groups, double entendres and irony.

High-quality data is typically derived through the devising of patterns and trends through means statistical pattern learning. Text mining frequently involves the process of framing the input text (usually parsing, along with the totaling of some derived linguistic features and the removal of others, and subsequent insertion into a DB), deriving patterns inside the structured data, and lastly calculating and interpretation of the output. 'High quality' in text mining usually refers to some particular combination of relevance and interestingness. Typical text mining tasks include text clustering, concept/entity extraction, production of granular taxonomies, sentimental keyword analysis, document summarization, and entity relation modeling.

OPINION MINING ALGORITHM

Opinion mining is a kind of natural language processing for tracking the feel of the public about a particular product. Opinion mining, which is too called sentiment analysis, involves structure a system to collect and categorize opinions regarding a product. Automated opinion mining frequently uses machine, a type of artificial intelligence (AI), to mine text for sentiment. Opinion mining can be helpful in several ways. It can help marketers estimate the success of an advertisement campaign or new product launch, determine which version of a product or service are popular and identify which demographics like or Unlike particular product features. For example, a review on a website (online) might be

broadly positive about a digital camera, but be particularly negative about how trouble it is. Being able to identify this kind of information in a systematic way give the vendor a much clearer picture of public opinion(suggestions) than surveys or focus groups do, because the data is created by the customer.

There are some challenges in opinion mining. The first word that is consider to be positive (+ve) in one circumstances it may be consider as a negative (-ve) in some another situation. Take the word "long" for instance. If a purchaser said a laptop's battery life-time was long, that would be a positive (+) opinion. If the purchaser said that the laptop's start-up time was too long, however, that would be is a negative (-) opinion. These differences mean that an opinion mining system trained to gather opinions on some type of product (goods) or product feature may not perform very well on another.

Opinion mining is a subtopic of information (data) retrieval with considerable research done. Several methods exist to find out an author's view on a topic from natural language (NL) textual information. These generally employe some form of machine learning approach, and have unreliable degrees of effectiveness.

SENTIMENT ANALYSIS

It is also known as opinion mining refers to the use of natural language processing (NLP), text analysis and computational linguistics to identify and extract (mining) subjective information in source materials. Sentiment analysis is widely applied to reviews, suggestion and social media for a variety of applications, ranging from marketing to customer service.

Classification

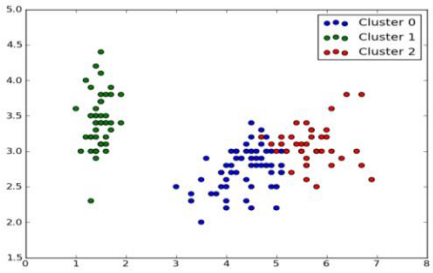
There are two major forms of data analysis that can be used for extracting models describing important classes or to predict future data trends. These two major forms are as follows

- Classification
- Prediction

Classification models predict categorical class and prediction models predict continuous valued
functions. For example, we can build classification model to categorize bank loan applications as
safe or risky, or a prediction models to predict the expenditures in dollars of prospective customers on computer equipment given their income and occupation. Following are the examples of cases where the data analysis (DA) task is Classification.

Examples

- A bank loan officer wants to analyze the data in order to know which purchaser (loan applicant) is risky or which are safe.
- A marketing manager at a company needs to analyze a purchaser with a given profile, who will buy a new computer.
- In both of the above example, a model or classifier is constructed to forecast the categorical labels. These labels are unsafe or safe for loan application data and sure or not for marketing data.



IV. CONCLUSION

The concept of this paper is to determine the customer reviews of mobile phones at aspect level. System performs the Opinion mining on the given reviews and the feature wise summarized results generated by the system will be useful for the user in taking the decision .Experimental results indicate that the 'opinion mining algorithm' perform well and has achieved the accuracy of 93.2%.Opinion mining algorithm is necessary because nowadays everyone is busy and they don't have a time to read all the positive or negative reviews if someone just wants to know about some feature of the product. Opinion mining has proved to be helpful in these situations as compared to simple opinion mining.

In future work, these efforts would be done to make some enhancements in this technique in such a way that it can identify the repeated reviews and classify those user reviews only once.

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Research on Classification and Recognition Algorithm of the High-resolution Remote Sensing Image on Chinese Ancient Villages

Zheng Jin, Liu Su, Zou Kunlin, Wu Wanneng, Sun Wei

***Abstract*— As an important carrier of the Chinese traditional cultural heritage, the ancient villages are gradually disappearing. Fortunately, many experts and scholars at home and abroad are paying more and more attention on the ancient villages' protection with the help of high-resolution remote sensing images. Considering that the surface features in the images are so diverse and complex, a new classification and recognition algorithm toward the high-resolution remote sensing images is proposed in this paper. The proposed algorithm is mainly based on the ensemble learning thought. With the algorithm, the image is firstly processed with multi-scale and multi-feature segmentation, and then the spectral and texture features are extracted as the input element of the classification and recognition process. Finally, the eventual classification and recognition results are decided by the ensemble classifier which is constructed by multiple SVM (Support Vector Machine) basic classifiers trained with the AdaBoost algorithm. The verification experiments indicated that the proposed algorithm has an obviously better effect than the traditional methods.**

***Index Terms*— Ancient village protection, High-resolution remote sensing image, Multi-scale and multi-feature segmentation, Ensemble learning.**

I. INTRODUCTION

The ancient village, the so-called folk Ecological Museum [1], is the gene pool of Chinese national culture [2]. However, its former prosperity has been gradually disappearing due to the passage of time, poor repair and the modern economy impacts. Besides that, the ancient villages are usually located in the remote environment and rugged terrain. In recent years, as the domestic and foreign experts have paid great attention to the ancient villages in our country, the ancient village protection is becoming increasingly urgent [3-6].

At present, the ancient village conservation is mostly planned with traditional ways and means, which mainly collect and analyze the basic data under current situation from the perceptual point of view. Unfortunately, their processing speed and accuracy are both poor. So the ancient village conservation planning cannot make a scientific analysis when taking a comprehensive consideration of the relevant data's interaction impact. As the ancient village protection is a really long-term and dynamic system engineering, it needs a dynamic control and adjustment in the whole process. Therefore, it requires the departments of planning, design and management to promptly grasp the various dynamic data with a reflection of the current situation and to serve them as the protection and management evidence for the administrator departments. So, it is difficult for the traditional method to meet the needs of the developing situation. And it is urgent to explore new technologies and methods to solve the problems encountered in the protection planning and management of the ancient villages.

As many new theories and methods in the domain of pattern recognition and artificial intelligence are proposed, as well as the continual exploration to the human vision mechanism, scholars at home and abroad have made lots of progress in the research of high-resolution remote sensing image classification and recognition, from the initial pixel-based statistical classifications gradually penetrating into the intelligent object-oriented automatic classification. For instance, Thias-Sanz etc. [7] proposed a bridge detection algorithm for the small-format high-resolution panchromatic remote images based on the texture feature and geometrical model, using neural network to classify the pixels. Although effective, it is not suitable for the extraction of the large-format and cross-river bridges. Chini etc. [8] did the change detection analysis for the artificial structure of the high-resolution satellite remote sensing image by the classification method based on statistics and neural network. It is found that the parallel classification method based on neural network classification accuracy is higher than the former. Melgani and Bruzzone etc. [9] used the SVM algorithm to classify the hyperspectral remote sensing image data respectively considering one to one, one-to-many and other cases. The experimental results showed that all of the classification accuracy, stability and robustness under the SVM method are better than both the RBF neural network and the K-nearest neighbor classification method.

In order to make the computer classify and recognize the remote sensing images better in line with the human visual information processing mechanism and ways of thinking, researchers have attempted and explored to introduce the thought of expert system, visual model, classifier combination and so on. Mathieu etc. [10] completed the feature classification for the New Zealand region's villages and towns through the object-level analysis of the remote image. Yi etc. introduced the words package model into the remote image as a guide, then analyzed the semantic relationships between the

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visual words according the PLSA model, and further completed the classification and identification of the high-resolution remote image. Mo etc. [11] took the high-resolution remote sensing image data IKONOS as a major data source, and then automatically extracted the land cover and land use information in the rural-urban area of Zhuzhou City, China, through the multi-scale segmentation and the object-oriented image analysis method based on fuzzy logic classification.

However, the existing target recognition methods of the high-resolution remote sensing images can only be used to detect one certain unnatural object, such as the roads, buildings, airports, bridges, ports, oil depots, ships and so on. In other words, a lack of traditional methods can universally detect different kinds of target features in the images. To better meet the practical application demands and expand the development prospect of the high-resolution remote image, some research focuses are emerging, such as that: how to build a highly efficient intelligent classification recognition algorithm, how to comprehensively consider the abundant information features in the image, how to convert the visual cognition to computer rules, how to further effectively analyze different kinds of target information in the remote image and so on.

II. The Preprocessing of the High-resolution Remote Sensing Image on Ancient Villages

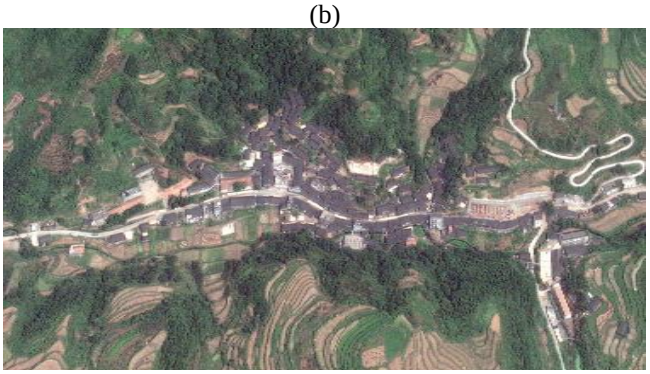
As some force majeure, including satellite disturbance, atmospheric conditions, sensors etc., are inevitably produced in the remote image capture process, it tends to generate random errors which would results into the image degradation in the aspects of intensity, frequency and space. The degradation effect mainly contains the contrast decrease, edge blur and geometry distortion, which would affect the analysis and decision-making in the subsequent application of the images. The information contained in the high-resolution remote images is especially abundant. If they are not preprocessed suitably, it may bring a lot of problems such as a large number of the generated false features, the lost real characteristics, the feature information errors and so on. To improve the SNR (Signal Noise Ratio) of the images and make sure the exact extraction and identification of the remote image target, the restore operation toward the image is necessary, which is namely the preprocessing of the remote image.

In this paper, three high-resolution remote sensing images will be selected as the experimental research materials, as shown in Figure 1.

Experimental image I: a 0.16m resolution of low altitude UAV (unmanned aerial vehicle) image in Taiping Town, Lushan County, China, captured in April 20, 2013, as shown in Figure 2.1 (a).

(a)

(b)



(c)

Figure 1 The original experimental images.

Experimental image II：a GoogleEarth image of Gong Jia Wan, Huaihua City, Hunan Province, China, captured in September 2009, with the angle of view 1.04km and a size of 1315×679, as shown in Figure 1 (b).

Experimental image III：a GoogleEarth image of a paddy fields village, Chenxi County, Hunan Province, captured in September 2009, with the angle of view 774 meters and a size of 1341×687, as shown in Figure 1 (c).

III. The Classification with Ensemble Learning Method

According to the diversity of the ground objects and the complexity of the space distribution in the ancient villages high-resolution remote sensing images, as well as considering the limitations of a single classification algorithm and the complementarity between different classification methods, a multi-classifier fusion method based on the ensemble learning thought can be introduced to classify and recognize the high-resolution remote sensing images on the ancient villages. The proposed method would improve the quality of classification and recognition, and further optimize the results.

A. Ensemble learning

Ensemble Learning is a machine learning paradigm which firstly study on the same problem by a limited number of learning devices， and then integrate the outputs of each learning device following some certain rules. It conforms to the human thinking habit as well as significantly improve the generalization ability of the system algorithm, which has been widely used in many fields, such as speech recognition, text classification, intrusion detection, image retrieval and so on[12].

According to the type of training algorithm, it can be divided into isomorphic integration and heterogeneous integration [13, 14]. Homogeneous ensemble learning is

based on a single learner, which generates different basic learner according to the construction strategy. However, heterogeneous ensemble learning is based on different learning algorithms, using the difference between different learning algorithms to obtain different basic learners. Due to the inherent mechanism of the learning algorithm, it is difficult to provide a reasonable and unified measurement analysis of integration effect, and the use of different learning algorithms will result in an increase in the overall complexity of the integrated learning. Therefore, most of the current ensemble learning researches are focusing on the isomorphic ensemble learning.

Multi-classifier ensemble learning is a typical application of the ensemble learning on classification problems, which improves the classification performance of a single classifier by fusing the predictive output of several homogeneous or heterogeneous classifiers. According to the ensemble learning system, it can be known that multi-classifier integration is usually composed of two stages [12]: the base classifier construction (learning stage) and base classifiers combination (application stage), whose basic framework is as shown in Figure 2.

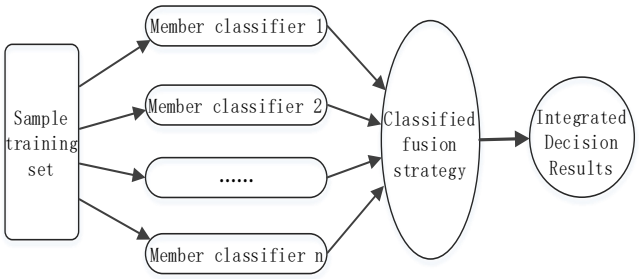


Figure 2 Basic framework of multiple classifier ensembles.

B. *The principle of the algorithm*

SVM (Support Vector Machine) was originally developed from solving two types of classification problems, whose essence is taking the easily mistaken training examples as a breakthrough to solve the problem. The main idea of classification is taking the "hard to distinguish and easily mistaken" sample as support point of classification surface, and then optimize the classification discriminant surface to make the biggest distance of support surface of positive and negative categories. As for the limited training sample data in high dimensional feature space, the classifier also has strong generalization ability while even a small sample is selected as a support vector to design the classifier. The structure of the algorithm is automatic optimal generation, which can reduce the test time and effectively solve the small sample problem.

As the SVM has a good performance, its application is gradually extended to the multi-class classification, which can be combined with several two-class classification SVM under certain criterion [13]. But there are still some problems to be solved in the rules of the combination, such as that the classification performance is not as outstanding as two-class problems solving. Besides that, the implementation of the multi-class classification is more complex. However, the architecture of multi classifier ensemble provides a powerful theoretical idea to the improvement of classification and generalization performance for SVM in multi-class classification problems.

AdaBoost algorithm is one of the most popular types among the Boosting algorithm clusters, and it is very simple to construct a member classifier with it. It also can obtain a very high precision when doing the integrated classification decision [14]. Considering the limitation of the experimental sample set in this paper, the multi-classifier fusion classification recognition algorithm based on the base classifier of SVM and AdaBoost construction method will be used to recognize and classify the elements of the ancient village of high-resolution remote sensing image.

The algorithm is based on the iterative idea of AdaBoost algorithm to train the SVM based classifier with the RBF as the kernel function: assumed a weight distribution D_t on the training set X_{tr}. In the *t*th iteration, assumed that each training session is assigned a weight of $D_t(x_i)$. According to the weight distribution of D_t, randomly select a sample $X_{tr}^{(t)}$ from the X_{tr} and take the sample (the input of SVM) as the base learning algorithm to train a base classifier C_t and calculate the classification error ε_t. Use this error to measure the performance of the base classifier C_t and update the weight distribution of the training samples. After a certain iteration cycle or when a predetermined precision is achieved, *T* base classifiers would be obtained. Carry on the fusion operation by weighted majority voting rule and then finally a strong classifier with a better decision performance is obtained.

C. *Algorithm description*

Given training sample set $X_{tr}=\{(x_i,y_i)\}_{i=1}^{N}$ and the iteration number (weak classifier number) T. Given initial weight $D_1=\{w_{1i}=1/N\}$, ($i=1,2,\cdots,N$) to each training individual (x_i,y_i) in the training set X_{tr}.

1) According to the weight distribution of D_t, conduct N times random sampling with replacement from the training set X_{tr} and a new training set is gotten as $X_{tr}^{(t)}=\{(x_i^{(t)},y_i^{(t)})\}_{i=1}^{N}$;

2) Take $X_{tr}^{(t)}$ as the input of a given base classification algorithm RBF-SVM and train it to get a base classifier C_t;

3) Calculate the classification error ε_t of base classifier C_t on the training sample set;

$$\varepsilon_t=P(C_t(x_i)\neq y_i)=\sum_{i=1}^{N}w_{ti} \tag{1}$$

4) If $\varepsilon_t>0.5$, set $D_{t+1}=\{w_{(t+1)i}=1/N\}$ and go to step 1; Otherwise, reset the weight of the RBF-SVM based classifier α_t;

$$\alpha_t=\frac{1}{2}\ln[(1-\varepsilon_t)/\varepsilon_t] \tag{2}$$

5) Update the weight distribution of training samples D_t

$$D_{t+1}=\{w_{(t+1)i}=\frac{w_{ti}\exp(-\alpha_t y_i C_t(x_i))}{Z_t}\} \tag{3}$$

where Z_t is the normalized factor normalization factor, which makes D_{t+1} a probability distribution

$$Z_t=\sum_{j=1}^{N}w_{tj}\exp(-\alpha_t y_j C_t(x_j)) \tag{4}$$

6) If $t=T$ or when the specified accuracy is achieved, output the final strong classifier $C(x)$ according to the majority voting fusion rule

$$C(x)=\arg\max(\sum_{t=1}^{T}\alpha_t C_t(x)) \tag{5}$$

IV. Experimental Results and Analysis

To analyze the performance of the classification and recognition algorithm proposed in this paper (the multi-classifier ensemble classification algorithm), the nearest neighbor and neural networks classification methods are selected as the comparative references in the comparative experiments, which are performed based on ENVI5.0 platform.

Algorithm validation and accuracy assessment are the fundamental problems of the remote sensing data processing and classification, which are the important steps when comparing different classification algorithms. When evaluating the remote sensing images' classification accuracy, the confusion Matrix is the most commonly used. It is a specific measurement which compares both the classification result and the actual predicted value. By comparing the actual classification and the predicted classification results of the surface area, the relationship between the actual class and predicted class can be recorded.

If given N zones, with the output class C, so the confusion matrix M is:

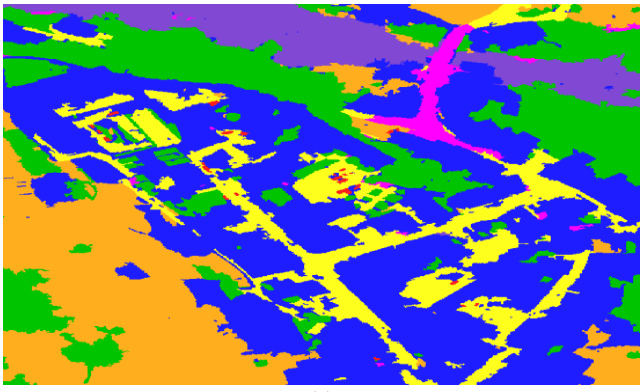
$$M = \{m_{ij}\} \tag{6}$$

where the m_{ij} represents the total number of the real class i in which the area is recognized as a category j. The greater the value of the diagonal elements in the confusion matrix is, the higher the reliability of the classification results are. Similarly, the greater the value of the non-diagonal elements in the confusion matrix is, the more serious the error classification is. According to it, the main indicators of the classification accuracy include production accuracy, user accuracy, the overall accuracy and *Kappa* coefficient [7]. In this paper, the *Kappa* coefficient which is more comprehensive to reflect the overall accuracy is selected as an evaluation metric. A greater *Kappa* coefficient indicates a higher classification accuracy of the corresponding classification methods.

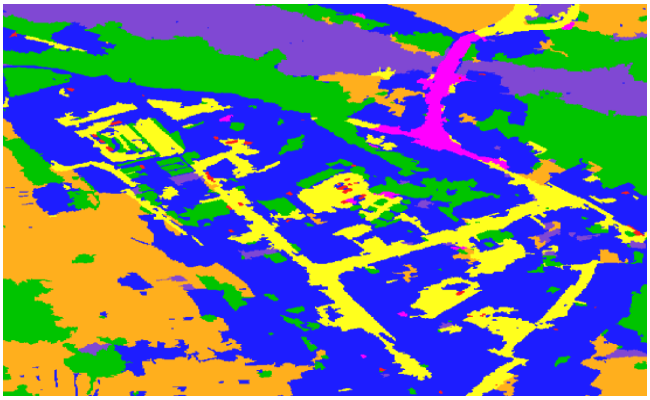
$$Kappa = \frac{N\sum_{i=1}^{C} m_{ii} - \sum_{i=1}^{C}(\sum_{j=1}^{C} m_{ij} * \sum_{j=1}^{C} m_{ji})}{N^2 - \sum_{i=1}^{C}(\sum_{j=1}^{C} m_{ij} * \sum_{j=1}^{C} m_{ji})} \tag{7}$$

A. *The first group of experiments*

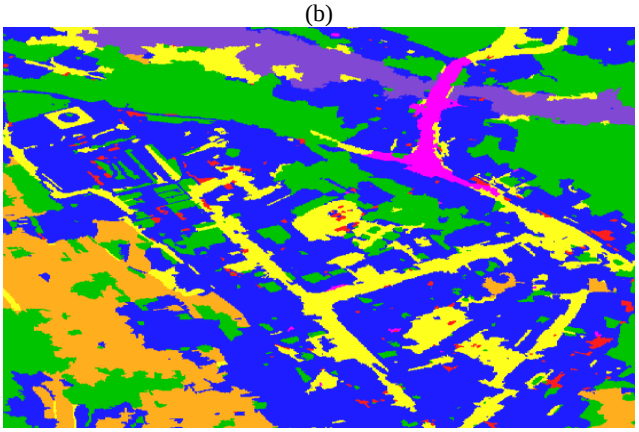
The experimental image I, the Taiping town picture, is firstly adopted in the experiment. Three small parts are further selected to be processed with different algorithms. And the classification and recognition effects are respectively shown in Figure 3, Figure 4, and Figure 5.



(a)



(b)



(c)

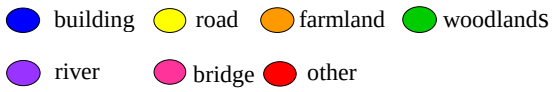


Figure 3. The classification and recognition results of the 1st Taiping town image: (a) Classification and recognition algorithm proposed in this paper; (b) Neural network classification; (c) Nearest neighbor classification.

For the Figure 3, the algorithm parameters of each method should be set as follows.

(1) The parameters of the proposed algorithm in this paper should be set as:

T: 30; *N*: 20; *Gamma*: 2.5; *Penalty Parameter*: 600.

(2) The parameters of the neural network classification algorithm should be set as:

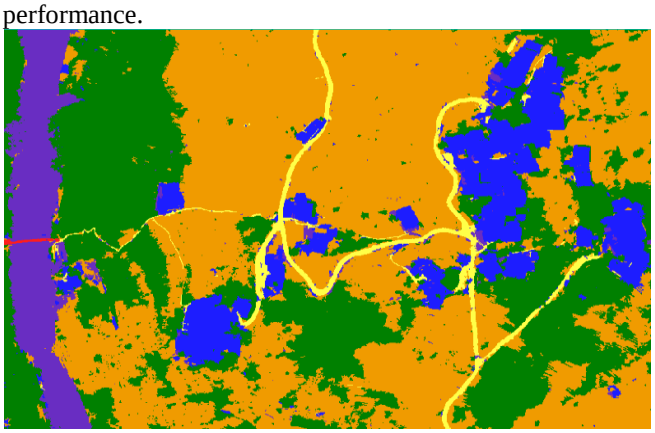
Number of Hidden Layers: 1; *Number of Training Iterations*: 600.

(3) The parameters of the nearest neighbor classification algorithm should be set as:

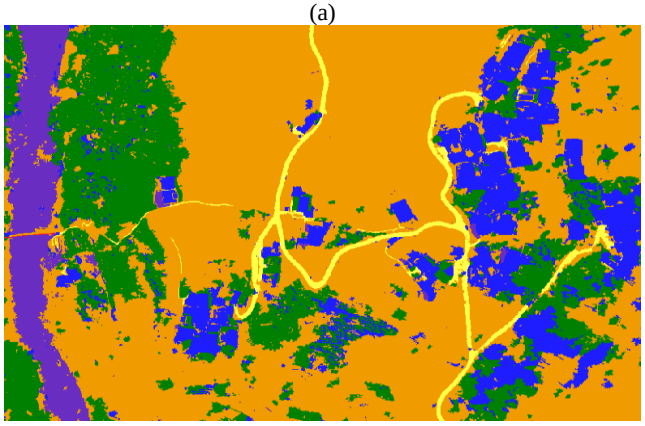
Neighbors: 6; *Threshold*: 5.0.

As the modern roads are similar to the modern buildings on material texture, it usually leads to a misclassification error between the roads and buildings. Besides that, part of road would be misclassified as bridge as a result of the connection error between them. In the experiment, it is found that the nearest neighbor classification algorithm misclassifies the part of farmland as building, and the modern building as road, the phenomenon of which is relatively serious. And some flood land would be classified as road because the similarity of the flood land and road. Similarly, with the neural network classification method, the classification error between the farmland and building is relatively large, and the error also exists among the part of road, building and farmland. In comparison, the classification and recognition algorithm proposed in this paper can avoid the above misclassification to a large extent. According to the *Kappa* coefficient as shown

in Table 1, the classification and recognition algorithm proposed in this paper has an obvious improvement compared with the neural network method and the nearest neighbor method. So the proposed algorithm has a better classification performance.



(a)



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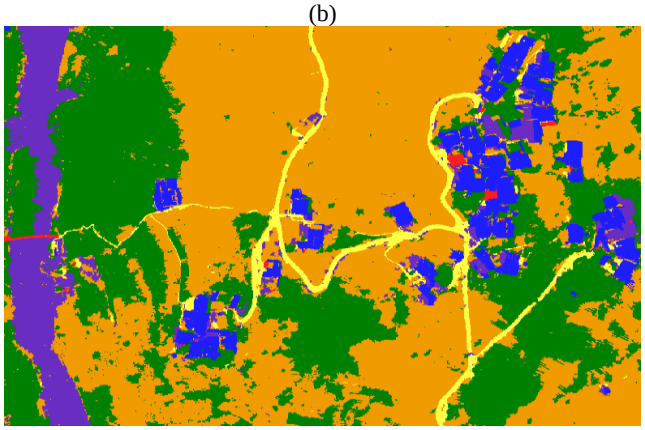


(c)

Figure 4. The classification and recognition results of the 2nd Taiping town image: (a) Classification and recognition algorithm proposed in this paper; (b) Neural network classification; (c) Nearest neighbor classification.

For the Figure 4, the algorithm parameters of each method should be set as follows.

(1) The parameters of the proposed algorithm in this paper should be set as:

T: 30; *N*: 20; Gamma: 0.3; *Penalty Parameter*: 500.

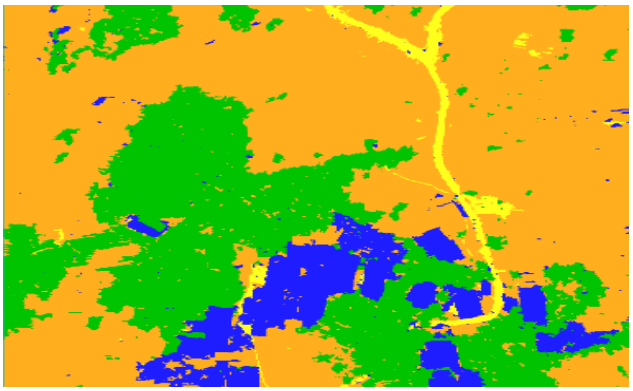
(2) The parameters of the neural network classification algorithm should be set as:

Number of Hidden Layers: 1; *Number of Training Iterations*: 600.

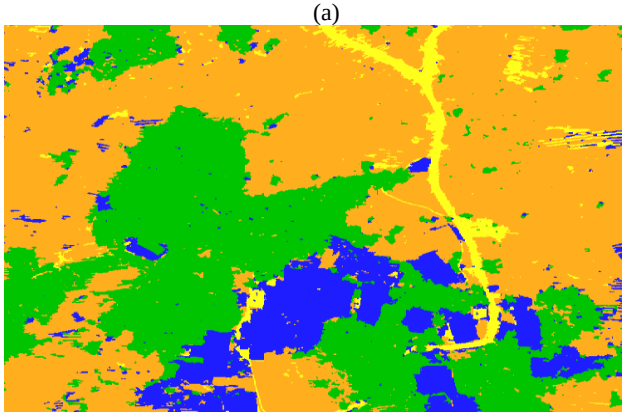
(3) The parameters of the nearest neighbor classification algorithm should be set as:

Neighbors: 3; *Threshold*: 3.5.

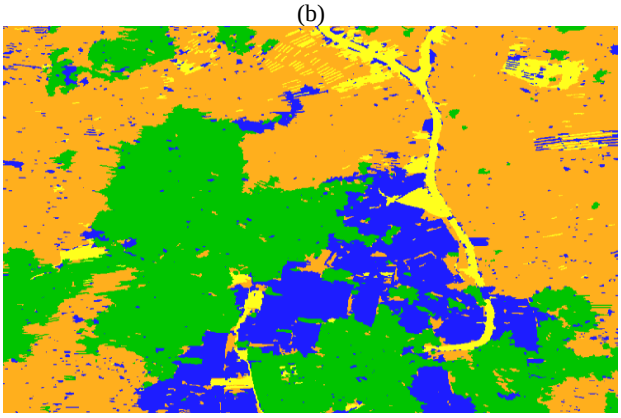
The experimental results indicate that the classification and recognition algorithm proposed in this paper effectively avoid the following phenomenon: the nearest neighbor classification method misclassifies the river as woodland and the jungle is misclassified as building with the neural network method. As shown in Table 1, the *Kappa* value of the proposed method is obviously higher than the contrast method. So with this, the classification accuracy is relatively improved, the overall recognition results are close to the actual distribution.



(a)



(b)



(c)

Figure 5. The classification and recognition results of the 3rd Taiping town image: (a) Classification and recognition algorithm proposed in this paper; (b) Neural network classification; (c) Nearest neighbor classification.

For the Figure 5, the algorithm parameters of each method should be set as follows.

(1) The parameters of the proposed algorithm in this paper should be set as:

T: 30; *N*: 20; *Gamma*: 0.02; *Penalty Parameter*: 500.

(2) The parameters of the neural network classification algorithm should be set as:

Number of Hidden Layers: 1; *Number of Training Iterations*: 600.

(3) The parameters of the nearest neighbor classification

algorithm should be set as:

Neighbors: 3; *Threshold*: 2.7.

In Figure 5, the housing distribution is clustered, meanwhile the farmland and forest land occupy a relatively large proportion of the image. But with the traditional nearest neighbor classification method, a lot of mistakes would appear. When neural network is used, the classification precision can be relatively improved, but farmland and woodland areas would still be misrecognized as building. Fortunately, with the classification and recognition algorithm proposed in this paper, the classification result is relatively close to the actual distribution.

Table 1. The *Kappa* coefficient of the Taiping Town ROI images

Classification recognition method	Figure 3	Figure 4	Figure 5
Nearest neighbor classification	0.492	0.476	0.406
Neural network classification	0.623	0.774	0.720
Classification and recognition algorithm proposed in this paper	0.820	0.875	0.872

B. The second group of experiments

For the Figure 6, the algorithm parameters of each method should be set as follows.

(1) The parameters of the proposed algorithm in this paper should be set as:

T: 30; *N*: 25; *Gamma*: 0.03; *Penalty Parameter*: 600.

(2) The parameters of the neural network classification algorithm should be set as:

Number *of Hidden Layers*: 1; *Number of Training Iterations*: 500.

(3) The parameters of the nearest neighbor classification algorithm should be set as:

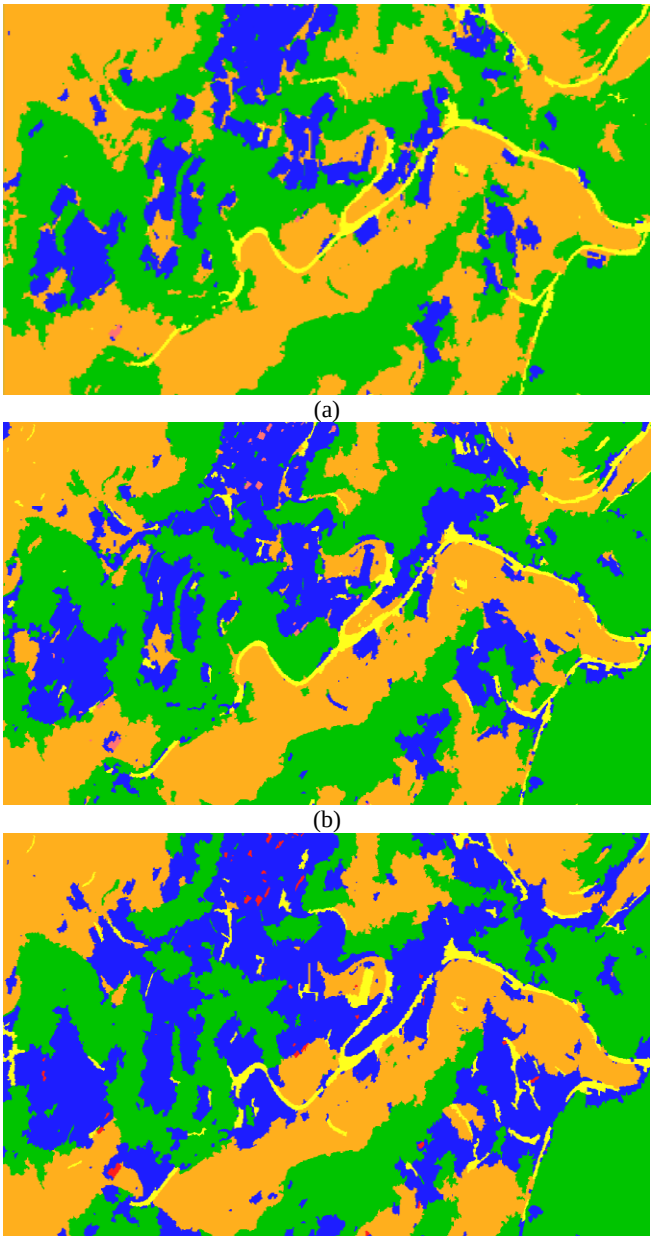
Neighbors: 3; *Threshold*: 1.2.

In this group of experiments, it is relatively serious that the nearest neighbor classification method would misclassify the farmland as building. Although the neural network classification method has an improvement to a certain extent, the classification accuracy is still low when comparing with the classified recognition method in this paper. As the *Kappa* coefficient in Table 2 showed that the proposed algorithm's classification accuracy had improved 49.1% and 21% when compared to the nearest neighbor classification method and the neural network classification method, respectively.

Table 2 The Kappa coefficient of Gong Jia Wan experimental image

	Nearest neighbor classification	Neural network classification	Classification and recognition algorithm proposed in this paper
Figure 6	0.413	0.695	0.904

From the Figure 6, it is serious that the nearest neighbor classification method would misclassify the farmland as building. Although the neural network classification recognition method has an improvement to a certain extent than the former, the classification accuracy is still very low when comparing to the proposed classified recognition method in this paper. According to the *Kappa* coefficient in Table 2, the proposed algorithm in this paper has a significantly improved performance compared with the former two.



(a) (b) (c)

Figure 6 The classification and recognition results of the Gong Jia Wan experimental image: (a) Classification and recognition algorithm proposed in this paper; (b) Neural network classification; (c) Nearest neighbor classification.

C. The third group of the experiments

For the Figure 7, the algorithm parameters of each method should be set as follows.

(1) The parameters of the proposed algorithm in this paper should be set as:

T: 30; *N*: 25; *Gamma*: 0.04; *Penalty Parameter*: 700.

(2) The parameters of the neural network classification algorithm should be set as:

Number of Hidden Layers: 1; *Number of Training Iterations*: 500.

(3) The parameters of the nearest neighbor classification algorithm should be set as:

Neighbors: 3; *Threshold*: 1.7.

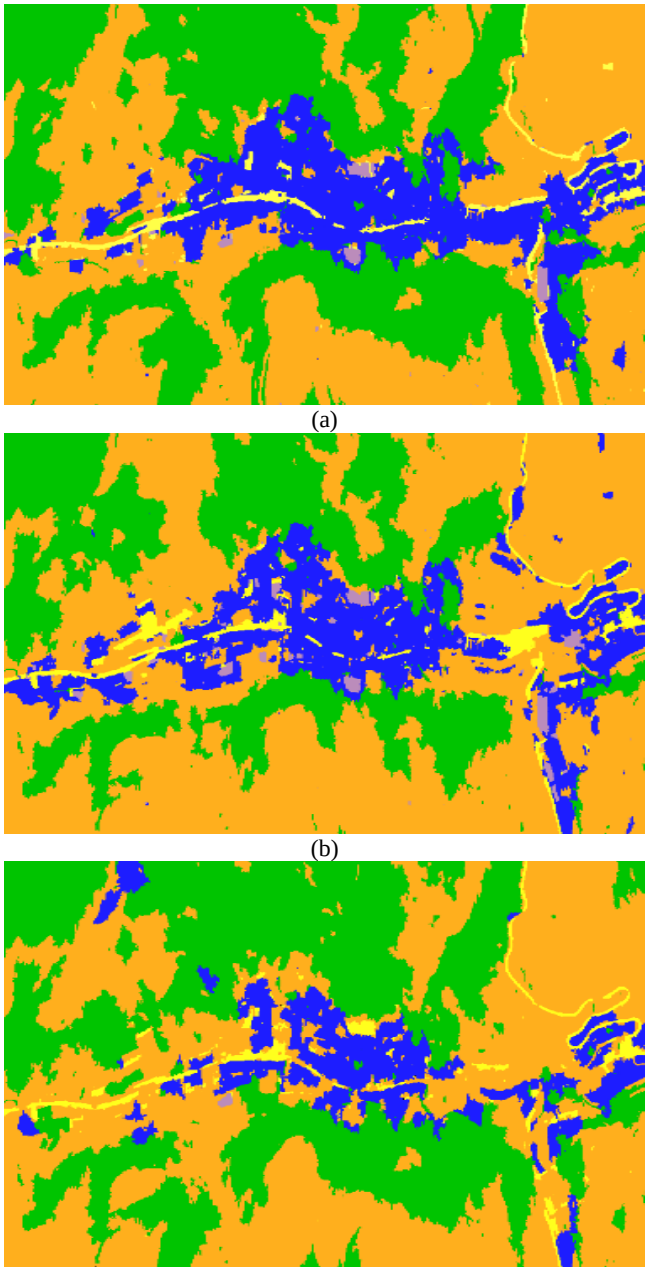


Figure 7. The classification and recognition results of the large paddy fields experimental image: (a) Classification and recognition algorithm proposed in this paper; (b) Neural network classification; (c) Nearest neighbor classification.

In this set of experiments, the results of all the three classification methods are relatively close to the actual distribution of the feature images to a certain extent. However, the nearest neighbor method would mistakenly classify some farmlands as buildings, and a large number of buildings have been recognized as farmlands. For the neural network classification method, it is a little serious that the buildings are identified as farmlands.

As the housing distribution is gathered, country road is narrow, and the distribution without rules, coupled with the shooting angle influence, some roads are usually blocked by architecture and jungle occlusion. Table 3 shows the Kappa coefficient of the proposed classification and recognition algorithm proposed in this paper has increased by 37.9% compared to the nearest neighbor classification method, significantly improving a lot compared to the previous two methods.

Table 3 The *Kappa* coefficient of the large paddy field experimental image

	Nearest neighbor classification	Neural network classification	Classification and recognition algorithm proposed in this paper
Figure 7	0.512	0.780	0.891

V. Conclusion

In this paper, the classification and recognition algorithms of the high-resolution remote sensing image on Chinese ancient villages are analyzed. As the surface features in the remote sensing images are so diverse and complex, the traditional algorithms such as the Neural Network and Nearest-neighbor algorithm can hardly universally detect different kinds of target objects. To better meet these practical application demands, a new method based on the ensemble learning and multi-classifier fusion in the pattern recognition fields is proposed in this paper. The main analysis thought has been along with the procedure as "remote sensing image preprocessing - image segmentation - classification and recognition". Finally, after a series of classification and recognition comparative experiments toward three original images, the proposed algorithm based on the multi-classifier ensemble learning thought has an obviously better effect than the Neural Network and the Nearest-neighbor classification methods, according to the Kappa coefficient shown in Table 1, 2 and 3.

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Pakistani Punjabi Men's Summer "Shalwar kameez" of upper class having income of US$ 5OOO/Month. Best practices and Spinning norms

Mr. Allah dad

***Abstract*— Cotton fabrics having important properties like moisture absorbent, soft handle and feel etc. And because of such properties it is the most dominant preference of the people of Pakistan as a fibre in their apparel because of long summer season .Textile sector plays a vital role in the economic growth of the country. In Pakistan, Punjab is most populated province and most of the people related to business or agriculture prefer to wear "Shalwar kammez" in summer. In this research paper the premium quality of woven cotton fabric was analyzed in terms of characteristics and properties for high income group people of having income around US $5000/ month located in various parts of the province. By studying and analyzing the norms of spinning and characteristics of fabric through various lab test, best practices were developed for the fabric. The norms were related to the demand of fabric and of customer like strength, wearing properties,handle , feel etc with respect to right fibre type, yarn type and the fabric construction.**

***Index Terms*—Cotton Fabric, Shalwar Kammez, feel, fibre.**

I. INTRODUCTION

The economy of Pakistan is directly related to the textile sector of the country, especially cotton containing products. The major portion of value added products and exports relates with the textile goods which is around 55% of total export value. On the basis of demand of cotton products Locally (inside the country) many of textile producers started their work on premium quality of cotton fiber products (such as the Extra Long Staple from the US) ,(Emeka Osakwe, May 18 2009). For premium quality of textile products , fibre length is considered the foremost characteristic (Richard, 2012), and has an one of most important character of premium quality yarn production. (Cui et al., 2009). To measure the length of the fibre which is known as staple length is to be measured by the fibro graph suggested by Hertel in 1940, consider most reliable measurement source of fibre length.(Hertel, 1940). Along this many other high tech measuring instrument such as USTER HVI, USTER AFIS PRO the staple length can be measured easily. The most lengths are characterized as the mean length (ML), the short fiber content (SFC), the upper quartile length (UQL), and so on. These parameters plays an important role in the manufacturing of staple yarn which is cotton based that directly approaches towards the quality of the yarn that ultimately leads towards the quality of the fabric.(Lin, Xing, Oxenham, & Yu, 2012). In Pakistan short length fiber is to be grown which accounts as short staple length and medium length of fibre such as 1/8 of inch. There are various types of cotton varieties planted and available in Pakistan which used in various textile goods such as CIM 496 in Punjab and NIAB-78, and CRIS-134 in Sindh. The staple is short and medium (although it mostly medium). The reason found for short and medium length of cotton fibre is due to the commonness insects and mealy bugs along climatic conditions(Emeka Osakwe, May 18 2009).The special characteristics of the woven fabric considered many important properties such as light weight, soft feel, cover factor, high drape, and well-designed look, ecofriendly for the premium quality of woven fabrics..((Swamy 2002), very restricted research has been carried out on the finest yarn and fabrics for certain culture and region but there is always need to address the important manufacturing processes of yarn and fabrics such as durability of the yarn in terms of tensile strength, bursting strength abrasion resistance.(Uttam and Gangwar 2006). The durability and strength of fabric not only rely on strength of the yarn used but also many other important factor for the manufacturing of premium quality of the woven fabrics (Morton 1949; Realff et al. 1997). It was concluded that there is correlation exists between yarn strength and the fabric structure (Essam 1929). The density of warp and weft yarns influence the flexural rigidity and modulus of the fabric (Cooper 1965; Gere2003; Guthrie et al. 1954; Lord and Mohamed 1982; Montgomery 2005; Nash 1972; Peirce 1930;Tuma 1993; uksekkaya et al. 2008). As the linear density of the yarn increases, the above two parameters also increases. Cotton fabrics of various constructions like plain, 1⁄3 twill, and 4-end irregular sateen have been made and the effect of fabric weave on different fabric properties such as mechanical properties, bending, and creasing behavior and appearance of the fabric are studied before .(Ashis Kumar Samanta, Asis Mukhopadhyay, Madhusudan M. Bhagwat &Tapas Ranjan Kar 2015) Ureyen and Kadoglu (2006) .A linear multiple regression method for the estimation of qualitative characteristics of yarn. They found that, in addition to fiber properties, yarn count, twist, and roving properties had considerable effects on the yarn properties.(Strumillo, Cyniak, Czekalski, and Jackowski(2007) determined the functional dependencies of selected fundamental parameters of cotton yarn quality such as tenacity, elongation, unevenness, hairiness, and the number of faults on the linear density of yarn. And with the increase in linear density (tex), tenacity, elongation, and hairiness increases, and the number of faults decreases.(El-Mogahzy (2006) .

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The objective of the design of any form in terms of fabric or a garment is to be defined by many properties and behavior of the product. The solution of the problem solved by meeting the requirements of aesthetics and physical demand.(Güngör Başer (2008). In this research paper the aesthetic demand concern color and feel but the physical demand account the fiber staple length, strength coefficient of variation , similarly for yarns the tensile strength, thick/thin places, evenness, and for the fabric the design parameter weave type, strength, density, warp and weft finesses. The design of the product woven fabric is to be set by assigning values to a set of parameters each denoting a property of the product. The values can be color, shape, behavior of the product.

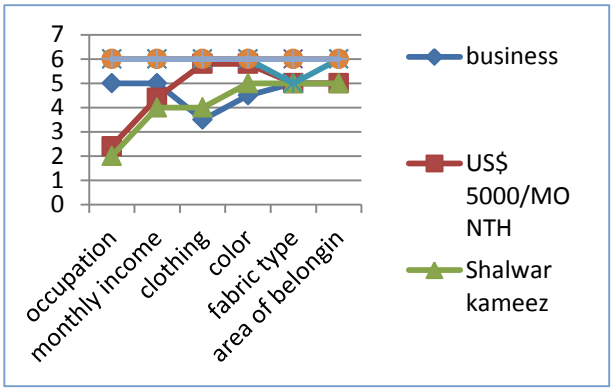
II. Methodology

Pakistan contains diversify cultures on the basis of region. In Pakistan Punjab is most populated province. The Punjab is Pakistan's second largest province at 79,284 sq miles and is the most developed, most populous, and most prosperous province of Pakistan., in general shalwar kammez, Paghri, lacha and dhoti are the common costumes of Punjabi people(Sarah Veach Katy Williamson Texas State University). The Punjab province contains two major regions one is central Punjab and second is southern Punjab. The major income source related to agriculture and its allied industries. In order to know the preference of Men's Apparel in Punjab, a small structured questionnaire that containing closed ended question is to be conducted by keeping in view the uniqueness of the research objective and research concern. The questions covers important observation directly related to the research questions. In given questionnaire the following question were asked about

1) occupation
2) Your monthly income
3) Please indicate which items of clothing you prefer to wear in the summer during your business hours?
4) Which part of the province do you belong to?
5) What qualities do you look for in your clothing?
6) Which colors do you prefer to wear during the summer
7) Which fabric type do you prefer to wear in the summer?

In conducting the survey the questionnaire is to be developed by considering mixed approach method. Typically simplifying occurs in mix method of qualitative and qualitative research. (Curtis, Gesler, Smith, and Washburn (2000) and Onwuegbuzie and Leech (2005c, 2007) Quantitative researchers tend to make "statistical" generalizations, which involve generalizing findings and inferences from a representative statistical sample to the population from which the sample was drawn. In contrast, many qualitative researchers, although not all, tend to make "analytic" generalizations (Miles & Huberman, 1994), which are "applied to wider theory on the basis of how selected cases 'fit' with general constructs" (Curtis et al., 2000, p. 1002); or they make generalizations that involve case-to-case transfer (Firestone, 1993; Kennedy, 1979). In other words, statistical generalizability refers to representativeness (i.e., some form of universal generalizability), whereas analytic generalizability and case-to-case transfer relate to conceptual power (Miles & Huberman, 1994). Therefore, the process of sampling is important to both quantitative and qualitative research. Unfortunately, a false dichotomy appears to prevail with respect to sampling schemes available to quantitative and qualitative researchers. As noted by Onwuegbuzie and Leech (2005b), random sampling tends to be associated with quantitative research, whereas non-random sampling typically is linked to qualitative research. However, choice of sampling class (i.e., random vs. non-random) should be based on the type of generalization of interest (i.e., statistical vs. analytic).. The sampling scheme was selected Simple in which Every individual in the sampling frame (i.e., desired population) has an equal and independent chance of being chosen for the study and Homogeneous in which Choosing settings, groups, and/or individuals based on similar or specific characteristics. The sampling case is to be selected Random Purposeful because of Selecting random cases from the sampling frame and randomly choosing a desired number of individuals to participate in the study. The choice of sample size is as important as is the choice of sampling scheme because it also determines the extent to which the researcher can make statistical and/or analytic generalizations. The sample size for analyzing the preferences of the respondents were 30 in number (e.g., Charles & Mertler, 2002; Creswell, 2002; Gall, Borg, & Gall, 1996; Gay & Airasian, 2003; McMillan & Schumacher, 2001).

The result of the surveyed questionnaire from a sample size of 30 in number which provides the evidence of Apparel selection that was Shalwar Kameez for the Punjabi people along their desired characteristics. The result is given in table 1:



Scale 0 -0.9 =05 Respondents
1-1.9= 05 Respondents
2-2.9 = 05 Respondents
3-3.9 = 05 Respondents
4-4.9 = 05 Respondents
5-5.9 = 05 Respondents
6-6.9 = 05 Respondents

The statistical data collected from the survey which is shown in above graphical representation. According to the result most of the respondents of equal distributed in central or southern Punjab province. The sample size of 30 respondents were in the favour of Men Apparel shalwar Kammez as apparel in summer season ,those belongs from upper class of having US$ 4000 TO 5000/ month. The selection of cotton fabrics due to moisture absorbency and light weight ,natural fibre , smooth feel and having comfortable wearing properties(A.J turner,2009 Natural and Man made fiber).Cotton has been used to produce yarns and fabrics from time immemorial. With the advent of

technologies and increased knowledge on cotton fibres, man has become able to control the properties of yarns and fabrics through proper selection of cottons and machinery parameters (Arindam Basu South India Textile Research Association, P.B. No. 3205, Coimbatore, Tamil Nadu 641014, India (Received 22 November 2007; final version received 3 May 2000).A large number of scientists have worked on the predictability of yarn properties based on fibre characteristics such as length, strength, fineness, inter-fibre friction, etc. Hunter (2004) has made a review of 200 articles related to this subject. Cheng and Adams (1995), Guha, Chattopadhyay, and Jayadeva (2001) and Jayadeva, Gupta, and Chattopadhyay (2003) made attempts to utilise the latest tools such as artificial neural network to predict the yarn quality on the basis of cotton-fibre quality. All the works reported good correlations between fibre properties and yarn properties. Kumar, Nishkam, and Ishtiaque (2005) studied the effect of inter-fibre friction on yarn quality. All of these studies were based on one cotton at a time, i.e. yarn was produced from single cotton, and relationships were derived.

III. Sampling and Test.

For the determining the characteristics of cotton woven fabric which is (shalwar Kameez) and the spinning norms, starting from the raw material, cotton fibre was selected of three types with respect to the origin and staple length.

a) Medium staple length (Pakistani cotton variety of staple length 1/8 inch with blend of long staple length fibre of Egyptian cotton)
b) Long staple length (American cotton of staple length 0.9 to 1.25 inch)
c) Extra long staple (Egyptian cotton of staple length 1 to 2.2 inch)
d) compact combed and carded Yarn.
e) Cotton fabric swatches

The tests were performed under controlled laboratory condition following the standards given by American Standard for Textile Material(ASTM)
The list of ASTM standards are:

- Pre conditioning of specimen for moisture equilibrium :ASTMD1776

Cotton fiber classification and testing time 4 hr relative humidity and temperature 21 ± 1 [70 ± 2] 65 ± 5(Standard Practice for Conditioning and Testing Textiles1 Designation: D1776/D1776M – 16)

- Tear Strength

ASTM D-1424
A slit is centrally precut in a test specimen held between two clamps and the specimen is torn through a fixed distance. The resistance to tearing is in part factored into the scale reading of the instrument and is computed from this reading and the pendulum capacity. Precondition the specimens by bringing them to approximate moisture equilibrium in the standard atmosphere for preconditioning textiles as directed in Practice D1776, sampling unit, take five specimens from the machine direction and five specimens from the cross-machine direction, Consider the long direction of the specimen as the direction of test. (ASTM Standard Test Method for Tearing Strength of Fabrics by Falling-Pendulum (Elmendorf-Type) Designation: D1424 – 09)

- Tensile Strength

ASTMD-5034
This test method describes procedures for carrying out fabric grab tensile tests using two types of specimens and three alternative types of testing machines. For reporting, use the following identification system of specific specimen and machine Tensile Testing Machine, of the CRE, CRL, or CRT type conforming to Specification with respect to force indication, working range, capacity, and elongation indicator, and designed for operation at a speed of 300 +/- 10 mm/min (12 +/- 0.5 in./min); or, a variable speed drive, change gears, or interchangeable weights as required to obtain the 20 +/- 3-s time-to-break. (ASTM Standard Test Method Breaking Strength and Elongation of Textile Fabrics (Grab Test Designation: D5034 − 09 (Reapproved 2013).

- Seam Strength

ASTMD-1683
This test method measures the sewn seam strength in woven fabrics by applying a force perpendicular to the sewn seam. test specimens, cut five specimens 350 6 3 mm [14 6 0.1 in.] by 100 6 3 mm [4 6 0.1 in.] with their long dimensions parallel either to the warp (machine) direction or to the filling (cross) direction, or cut specimens for testing from both directions if required. Fold the specimen 100 +/- 3 mm [4 +/- 0.1 in.] from one end with the fold parallel to the short direction of the fabric. After seaming, cut the fold open. The test specimen should contain a seam approximately 100 +/- 3 mm [4 +/- 0.1 in.] from one end. Each test specimen will contain sufficient material for one seamed and one fabric test. (Standard Test Method for Failure in Sewn Seams of Woven Apparel Fabrics, Designation: D1683/D1683M − 11a)

- Color fastness to washing

AATCC-61 2A

- Breaking strength and elongation

ASTMD-D5034
Cut each specimen 100 +/- 1 mm (4 +/- 0.05 in.) wide by at least 150 mm (6 in.) long with the long dimension parallel to the direction of testing and force application. (Standard Test Method for Breaking Strength and Elongation of Textile Fabrics (ASTM Standard Grab Test Designation: D5034 – 09)

IV. Results

A. *Norms of Fiber and yarn*

Yarn fineness	Cotton variety	Staple length mm	Uniformity ratio % Standard at 5%	Fineness as Micronaire	Tenancity (gm/tex)	CV %
60/s Ne	Egyptian Cotton 100%	25.6	10.44	2.9	26.3	12.3
56/s Ne	Pakistani cotton With Egyptian cotton 50:50 ratio	18.4	12.22	4	20	15.9

B. Spinning Norms with respect count Lea Strength Product

Yarn fineness	Lea Dimensions (120 yard)		CV%	U% (unevenness)
	Normal (Nm * kg) Nm=metric system	Premium cotton having staple length(Nm*kg)		
60/s Ne	1522		12	22
56/s Ne	1300		14	19

C. Norms of yarn with respect to twist

Yarn finesses	Minimum Twist per inch	Maximum twist per inch
60/s Ne	26	38
56/s Ne	22	32

D. Spinning Norms of the Cotton yarn (thick thin places and Grade of yarn)

arn fineness	Thick places/+50% / km length	Thin places/ -50%/ km length	Neps /+200%/ km length	Grade of yarn
60/s Ne	22	4	44	A
56/s Ne	100	53	70	A-

A. Fabric quality parameters and their norms.

Fabric construction	Breaking strength (lbf) ASTMD-1424		Elongation %		Tensile Strength (lbf) ASTMD-5034		Seam Strength ASTM-1683		Color Fastness to washing ATCC-61 2A	
	Warp	Weft	Warp	Weft	Warp lbf	weft lbf	Warp lbf	Weft lbf	shade change	Staining on cotton
60*60/124*104	2.5	1.89	12	14	86	58	51	45	4	4
56*56/110*100	2	0.98	8	8	82	51	45	42	4	5

CONCLUSION

The quality of the fabrics were analysed on the basis of all important spinning norms . By analyzing the results which is obtained from two different fiber and fabric construction, the fiber and yarn quality of the fabric construction 60*60/124*104 with all technical parameters is considered as best practices for shalwar kammez for the people of Pakistan. In Punjab province.The result shows that by using Egyptian cotton having long staple length and finesses range from 60 to 64 in single ply considered as suitable for fabric quality .

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P Diffusion welding of commercial Aluminum to Carbon Steel

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Abstract— **This research is aimed to study the effect of using insert materials on the strength of the diffusion welding joints between commercial–grade Aluminum(AL200) and carbon steel (S20C).**

In this experiment as well as clarifying the mutual relation between the insert materials and welding conditions, the relation between the strength of a joint and the formation of compound layer also investigated. Besides the study of metallurgical effects of insert materials using by accurate microstructure examination. it was found that the insert materials when used in a thin layered form, had important role in enhancing of the diffusion to weld materials which differ in their melting point. The result also showed the deformation rate of the joints is decreased when using insert materials with low yield stress at constant welding conditions.

Index Terms— **welding, diffusion, joint, temperature**

I. INTRODUCTION

The diffusion welding is one of the methods used to joint two different metals, jointed permanently, there are many advantages to this method as the welding in this way does not leave a mark on the two pieces welding and to joint the region[1], and the connecting force between the two pieces are very large and because it is caused by the spread of atoms as a result of raising the temperature, its entered invasive in many areas of manufacturing and production of precision instruments that need to be great sensitivity, such as electrical transistors industry as well as small parts of electronic computers [2].

Several experiments have been conducted in this area was where the welding different metals multi-most famously made by Kaukato group of Japanese were diffusion welding between pure aluminum AL100 and Mild steel using intermediate compounds such as Ti-Ni alloy, these experiments and studies included to identify some properties mechanical such as tensile strength and shock when you change different welding conditions as these studies showed that the effectiveness of the use of intermediate compounds depends on the quality of the thermal treatment performed on the mother of two pieces and on the nature of welding where if welding was one dip or more, and the results also showed that the conditions of welding (temperature, time, pressure) used an active role and a large effect on the mechanical strength of the welding connection[3].

In this research, conducted a study of the possibility of obtaining the maximum tensile strength of the connection welding through the use of intermediate compounds are (Ni, 2024 alloy, Ag), study and investigate the correlation between the output of the use of intermediate compounds and conditions of the welding process impact, as well as shed light on the relationship between the strength of the link and the formation of metal compounds described during obtain diffusion.

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II. THEORETICAL BASIS

The study of diffusion in important minerals in practice it happens as a result of the relative movement of atoms, as the atom moves from place to another within the crystal lattice of the metal and oscillate about its balanced, altering atoms site is the cause of diffusion in the material [4], and deployment is happening inside grained only, but on a grain boundary surfaces free, proving laboratory experiences that spread the granular border faster than it is inside the beloved and spread on the free surfaces faster of the two, and is attributable to the lack of agglutination granular border installation and surfaces free[2], and spread via the free surfaces and borders granular important because the grain boundary occupy much space and be a network covering the mineral sample, and the diffusion coefficient depends on the composition and temperature as the following equation describes the diffusion process[5].

$$D = D_o \exp(-Q/RT) \quad \text{.....(1)}$$

whereas :

D: Propagation coefficient
Do: frequency coefficient
Q: The activation energy for the diffusion
R: gas constant
T: Temperature

Practical experience has shown that different metals are not spread evenly rate, element which melts at low thermal grade spreads faster, for example, in the alpha Brass (a mixture of copper and zinc) zinc atoms spread faster than the copper atoms, but in a couple of diffusible composed of copper and nickel, the atoms copper spread faster [6], and as a result this is happening dilation and contraction of the surface interval expansion that occurs in the vertical direction on the surface interval (interface) have not disabled the contraction and expansion winning the direction parallel to the surface shall be disabled by a pair diffusion that does not spread it occurs parts Vicu the first part in the event stresses Hdih and the other in the case of stresses Pressure where displace atoms, and lead these stresses to the formation of thermoplastic (plastic deformation) [7], and accompanies this configuration are quasi-grained (sub grain) and Recrystallization and the growth of the grains.

There are several ways to spread are:

A. Interstitial diffusion:

Corn moving in this way from the site of Benny to the nearest site interface another without the occurrence of permanent

original atoms change (matrix atom), that this transition jump or be accompanied by spillover or deformation (distortion) and this distortion in the crystal is a barrier to proliferation, and this kind of commonly spread in alloys in which the atom occupies interface locations, it is a distortion and a small deployment does not need to voids (vacancies) [2].
And it expresses its interface diffusion coefficient as follows:

$D = \alpha\, a^2 Z V \exp(-\Delta F/RT)$ …….. (2)

whereas:

α : Geometric factor
a: Constant of crystalline
Z: Number associated with
V: Frequency
F: Energy needed to deploy

B. *Ring diffusion:*

The self-diffusion in metals and alloys are not caused by the direct exchange of atoms, because this method leads to the formation of large deformations in the crystal inappropriate in terms of energy stimulant, so the spread gets another way is ring diffusion where rotation of several atoms at the same time, this type adequate to explain some unusual phenomena coefficient diffusion in metals with body-centered crystal structure (B.C.C) [5].

C. *Vacancy mechanism:*

A winning spread because corn moved to the empty sites in crystals as the distortion in this case a little, so the energy that few are also needed, and this method is the most predominant in metals and alloys with different crystalline structures (BCC, FCC, HCP), and Vacancy mechanism also increases with rising temperature [8].

III. THE PRACTICAL SIDE

A. *The method of the experiment*

Chemical composition of the samples used are shown in table {1} and the basic materials used are AL200, S20C. The geometry of samples welding is cylindrical dimensions of the form (14×20) mm for the purpose of tensile test and (20×28) mm) for the purpose of Impact test and (10×14) mm for the purpose of the crystal structure using a microscope examination, the welding device diffusion, it was use measuring crawling device creep of metals for this purpose has been on the tensile stress to the stress put pressure on the welding samples, and use of electric resistance furnace for the purpose of the samples heated with thermocouple to set the temperature of welding, is welding in a vicious room air so as to prevent air leakage into the welding strictly prohibited , also used the hydraulic piston for use in welding some samples, and the time of the welding process to be determined with the arrival of the temperature to the desired degree and pre-set, also used a range of different intermediate materials, which were clarified thickness and the amount of purity in table{2}, where installed temperature and pressure and welding time with the change of use of the type of intermediate materials, and note the impact on the durability of the mechanical link and this is the second part of the practical aspect related to mechanical tests after the welding process the samples.

Table{1}: The chemical compositions of samples used

S20C	C	Mn	Si	S	P	AL	Fe			
	0.19	0.72	0.07	0.032	0.026	<0.005	Bal.			
AL200	Fe	Si	Cu	Zn	Ti	Mg	Mn	Cr	Pb	AL
	0.560	0.099	0.050	0.017	0.017	0.005	0.004	0.002	0.001	Bal.
A2024alloy	0.18	0.186	4.036	0.060	0.035	1.556	0.060	0.012	0.013	Bal.

Table{2}: The thickness and purity interfaces used

Insert material	Ni	2024alloy	Ag	Ti
Thickness (mm)	0.01	0.05	0.03	1.03
Purity (%)	>99.5		>99.9	>99.5

B. *Mechanical tests*

Conducted tensile tests using tensile testing device as calculated value of the tensile strength when the speed of the top cross head device and the amount of 0.5mm / min, and calculated the maximum tensile strength of the connection welding direction vertical to the line connecting the two samples connected, and the test was conducted using Charpy device to see how much carry link welding stresses shock by using the weight of 5kg so put piece in the examination to be the edge of a rock fall on the welding area of the welded samples during the examination, And make microscopic examination of samples welded near the dividing line between the welded samples at temperatures of various welding (500,520,540,600)^{o}C, having been assigned to the hot and conducted by gradually smoothing (110,420,500,1200)^{o}C and then refined by Alalmunya then Manifesting process conducted by Olnayatl 4% for a period of 6 seconds after the sample is washed with alcohol and dried to become a sample ready for microscopy and imaging.

IV. RESULTS AND DISCUSSION

When using metal sheets of alloy aluminum 2024 Al and raise the temperature initially at 513^{o}C at a rate of 2.5^{o}C/min, and to check heating of the change in the amount of the liquid phase, which arise from heating it after heating the ingot and auditing at different temperatures for 30 min. is galvanization in water iced, and then measure the amount of liquid phase. This can be seen in fig.(1), which shows the relationship between the amount of the liquid phase VL and temperature where we note that the size of 3.5VL of the liquid phase occurs at a temperature of 600^{o}C, also note that the number of crystalline granules which is calculated in a manner calculate the distance at least rapidly with temperature rise. Based on this result, the use of Ni, AL2024, Ag, Ti as material interfaces between S20C temperature welding fixed 600^{o}C and pressure welding equal to 20.065kg/m, is illustrated in fig.(2), which shows that when using Ni as a feedstock, the robustness of the link obtained be so that breakage occurs in the sample during the examination Turning works and using these four interfaces materials note that the use of Ag gives

maximum durability of the link and then come (2024 alloy) while giving Ti less solid connection to welding.

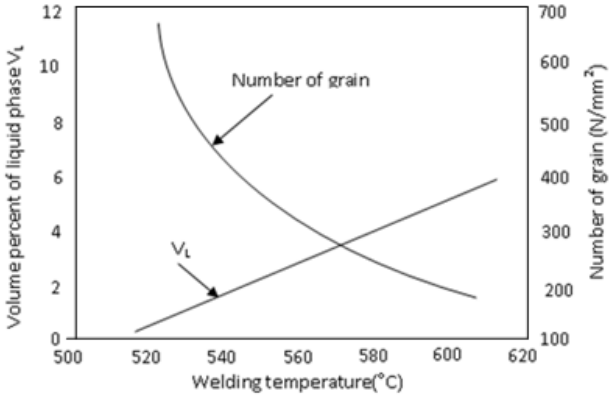

Fig.(1): The effect welding temperature on the amount of illustrates the liquid phase and the number of grains of the alloy

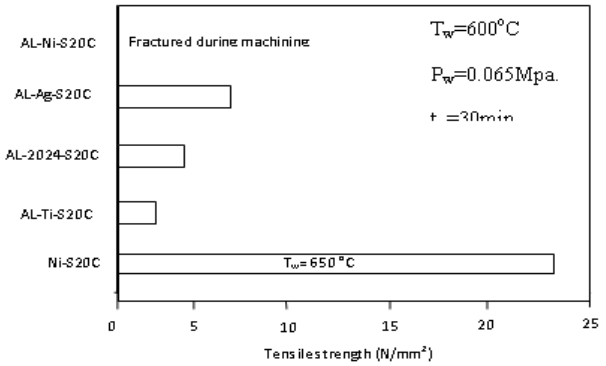

Fig.(2): the effect of interface materials on the tensile strength of the welding connection when welding conditions (pressure, temperature, time)

by fig.(3) can be observed ultrastructure next to the welding area for Ni with S20C obtained in this way, as well as the presence of a small concavity and convexity of the boundary between the two pieces and that such a movement of the line dividing believed it improved the robustness of the connected.

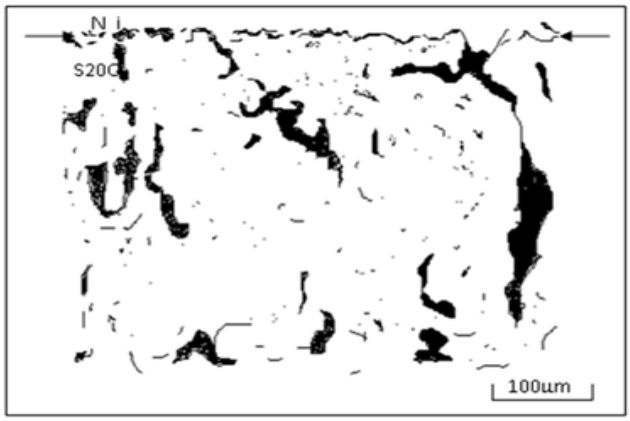

Fig.(3): Welding zone connection Ni-S20C when welding conditions

As fig.(4) explains the effect of temperature welding T_w the screwing of the link AL-Ni in the temperature 610°C, 650°C, the tensile strength of the link be equal to 4.7 kg/mm^2 using compression welding equal to 20.045 kg/mm. And it increases the tensile strength increased slightly when increasing the temperature of 640°C to 650°C.

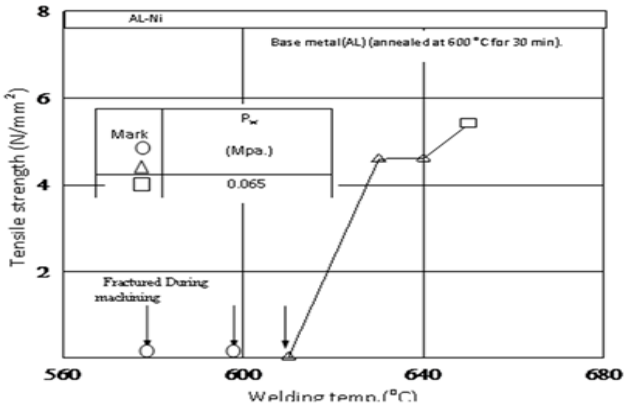

Fig.(4): The effect of the temperature of the welding on the tensile strength of the joint (AL-Ni) at a different pressure welding values (Pw)

The exact composition of the compounds interfaces formed at the boundary between the AL, Ni for the welding can be seen in fig.(5), when raising the temperature of 610°C to 650°C gets growth volumetric of these compounds, as shown in fig.(5).

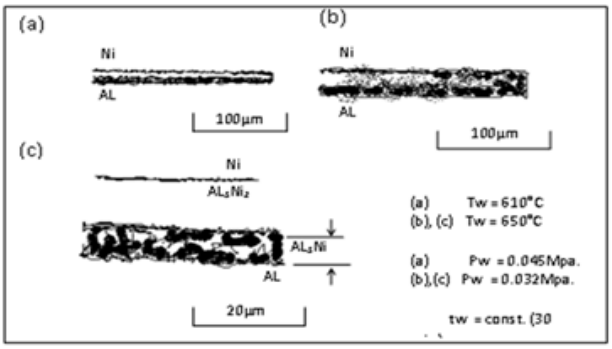

Fig.(5): Welding of the connection (AL-Ni) when the conditions welding for different pressure, temperature.

And fig.(6) shows the effect of the temperature of welding on the strength tensile connection welding AL - S20C note of the figure the amount of durability welding pieces conducted by thermal treatment (annealing) at 600°C for 30min, we find that the strength of the joint be close to the durability that happen by breakage of a piece examination during the boot process. We find that durability in connection welding AL-S20C be larger as you can in the temperature 520°C, with an increased temperature of welding as strong connected Welding, note that the feedstock used is alloy 2024 in the party AL and Ni in the party S20C, this result represents an indication of the fact that that T_w while increasing growth in the volumetric crystal boundary phases formed, which leads to increased Brittleness.

In fig.(7), which illustrates the impact resistance of the connection welding (AL-S20C), we find at a temperature of 600°C The impact resistance of a piece examination was almost equal to the amount which the fraction obtained during surface operation, and at a temperature of 520°C we get the maximum impact resistance manner and with increasing temperature less impact resistance.

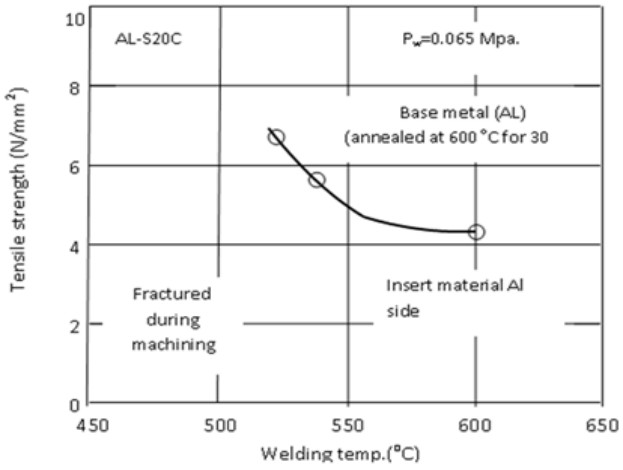

Fig.(6): The effect of the welding temperature on the tensile strength of the connection (AL-S20C)

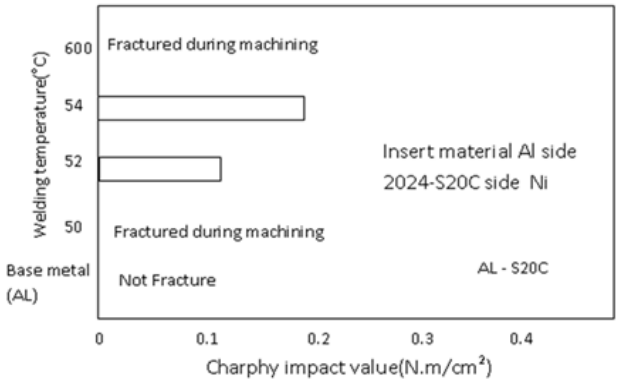

Fig.(7): The effect of the welding temperature on the impact resistance of the connection (AL- S20C)

V. CONCLUSIONS

1. durability connection welding depends on the type of intra-feedstock used in the welding process.
2. during diffusion welding for Ni-S20C must reach the temperature T_w at least above the temperature of any AL turned over 723^{o}C.
3. conclude from mechanical tests that breakage occurs between the interface and S20C in each case of the four cases, from above, we can prove that the temperature used 600^{o}C be inappropriate to get spread between the interface used and the S20C, if the temperature is raised over the diffusion will accelerate but gets deformation in a piece of aluminum which leads to sacrifice the most important feature is characterized by a trickle-down welding deformation of metals curb pain. In diffusion welding of metals, which vary greatly in degrees of melting as is the case in our experience, and when you do not get the durability required using the pre one layer of the feedstock with the metal with a high degree of fusion gives tremendous results, when welding nickel with S20C at a temperature 850 ^{o}C, the durability shall be equal to 772kg/mm^2 which is greater than the value of the metal is much pain.
4. high temperature of welding T_w increases volumetric growth interfaces used in diffusion welding, also lead to reduced tensile durability and impact resistance.

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Comparative study of data transfers using Wi-Fi modules

Gaurav Khadse, Ninad Adhav

***Abstract*— The need of wireless transfer of data from a microcontroller to an Android device or a desktop PC can be fulfilled by the use of a Bluetooth or Wi-Fi module. A token or a few bytes of data can be transferred using any Bluetooth module. However, a problem arises when the size of data increases to a few megabytes. A low cost Bluetooth module does not buttress the high data rate and switching to an efficient and faster Bluetooth module is an expensive alternative. A cost effective solution to this is using an easily available Wi-Fi module which is comparatively cheaper.**

This paper describes some important steps for setting up a Wi-Fi module, sending large amount of data using the Wi-Fi module, and comparing the speeds of the same module with different microcontrollers.

***Index Terms*— Arduino Mega, Arduino Uno, ESP8266, Teensy 3.2, Data Integrity, Baud Rate.**

I. INTRODUCTION

Data transfer from a microcontroller to an Android device or a desktop PC is easy when a newbie in the field of electronics has to send a token or a byte of data. The available wireless communication modules like Bluetooth and Wi-Fi make it possible to transfer data in minimal time. A newbie can setup a Bluetooth module in a few minutes by writing a simple sketch, and can send data over a Bluetooth module. Setting up a Wi-Fi module is cumbersome as compared to a Bluetooth module and it requires profound knowledge of embedded systems and networking.

When the amount of data to be transferred on an Android or desktop PC from an external SD card increases, the transfer speed becomes a challenge when it comes to a wireless transfer. Bluetooth speed deteriorates when the module is used with a high baud rate. The possible solutions can be using a high performance Bluetooth module or using Wi-Fi module. The high performance Bluetooth module has a large buffer size and a capability to handle high data rates. However, it is expensive as compared to a Wi-Fi module which is sufficient to satisfy the data transfer purpose given the overhead of setting it up.

To send a large amount of data from the sd card may take several minutes. To lessen the transfer time is also one of the challenges. A few tests have been performed and the data transfer is made fast and easy using one of the cheapest components available in the market.

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II. LITERATURE SURVEY

The transfer rate would depend upon a lot of factors. Out of all these, the two main factors would be:

1. How fast the sd card is being read and
2. How fast and efficiently the data is being handled by the Bluetooth or Wi-Fi module.

The second factor has been studied thoroughly and numerous experiments were performed on different Bluetooth and Wi-Fi modules to have a practically achievable transfer rate. This was reinforced by 100% data integrity.

The Bluetooth modules that had been taken into consideration were classic Bluetooth modules like HC05, RN41, RN42, and BT33. HC05, RN41, and RN42 don't have enough buffer size to handle large amount of data continuously. Hence the flow control was implemented using the RTS and CTS pins provided by these Bluetooth modules. But, after implementing the flow control, the transfer rate started to deteriorate drastically. These Bluetooth modules took approximately 1 Minute to send 1Mb of data. The BT33 seemed more efficient than the rest of the Bluetooth modules and therefore, the BT33 module, after having a proper implementation of flow control, was able to achieve higher transfer rate than the HC05, RN41, and RN42. But BT33 was not cost-effective. Also, only one instance of the Bluetooth module could be connected at a time with an Android device or with a Desktop PC. This could be overcome using a Wi-Fi module.

Therefore, Wi-Fi module was chosen and research began with finding a suitable Wi-Fi module which is reliable as well as cost-effective. After going through several Wi-Fi modules, the Espressif ESP8266-12e and Huzzah CC3000 were shortlisted.

After a lot of extensive comparison based on the following performance, compatibility, supporting forums, and cost of the modules, we selected the ESP8266-12e as the module for our tests.

ESP8266-2e has a programmable microcontroller but we preferred to test it with an external controller as we had other time-constraining tasks to perform using an external controller.

The following table outlines the basic structure of CC3000 and ESP 8266.

Wi-Fi chip/module	CC3000	ESP8266
Wi-Fi Standards	802.11 b/g	802.11 b/g/n
Packets	TCP and UDP	TCP and UDP
Modes	Client and Server	Client and Server
Concurrent Sockets	4	5
Access Point Modes	No	P2P, Soft-AP
Size	26.22 x 40.45 x 2.95mm	24 x 16mm
Interface	SPI	TTL Serial
Encryption	Up to WPA2-PSK	Up to WPA2-PSK
Sleep Current	-	<10 uA
Transmit Current	350mA	215 mA (typ.)
Receive Current	-	~60 mA
Digital Pins	0	9
Analog Pins	0	1
Other Pins	0	0 (E variant adds more)
Programmable Microcontroller	No	Yes
Cost (US Dollars)	$34.95	$3.37 – 6.95

Table 1. Comparison of Wi-Fi modules

III. Proposed Architecture

The esp8266-12e was tested with Arduino UNO and Arduino Mega in server mode. It was also tested with Teensy 3.2 in server as well as client mode. The mode is said to be a server mode when the esp8266-12e acts as a server and an external mobile or a desktop PC acts as a client. The mode is said to be a client mode when the esp8266-12e acts as a client. In this mode, the python server has to be created on a desktop PC.

General Configurations:

Wi-Fi Module Name: ESP8266-12e

Firmware used:

esp_iot_sdk_1.5.4 (New Firmware)

esp_iot_sdk_0.9.4 (Old Firmware)

Software Used:

Arduino IDE , Teensyduino, Python IDLE.

Hardware used:

Arduino Uno, Arduino Mega, Teensy 3.2

Connection:

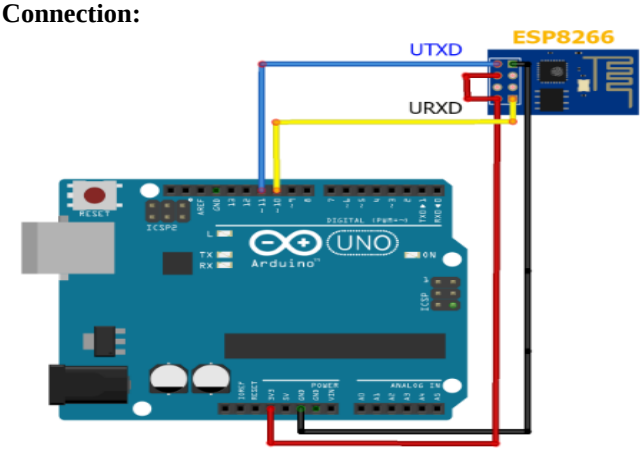

Fig 1. Connecting ESP8266 with Arduino UNO

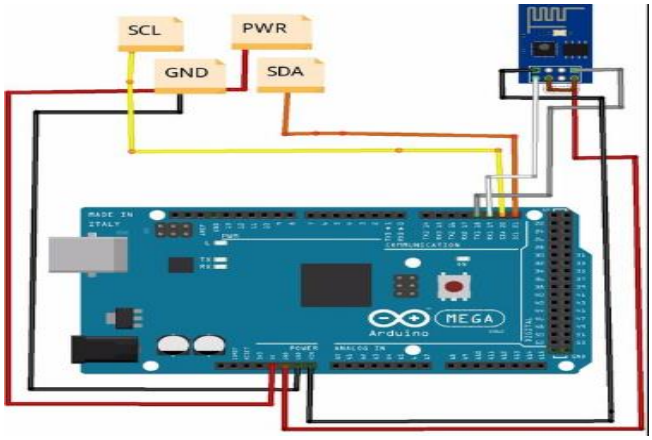

Fig 2. Connecting ESP8266 with Arduino Mega

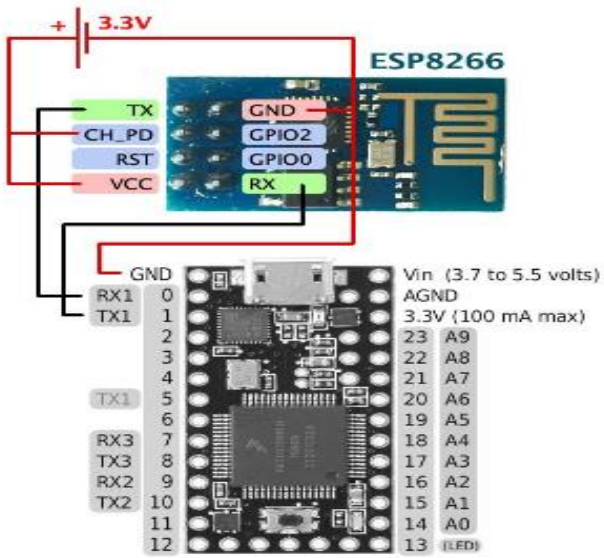

Fig 3. Connecting ESP8266 with Teensy 3.2

Common Steps for Data Transfer and Data Logging :

- Power up the device and upload the code.
- When checking data transfer on **Android Phone** –
  - Start Admin Hands App → Hosts
  - Create a new connection by selecting "+" sign at the bottom left.
  - Fill in the Fields with the IP Address and Port Number of the Wi-Fi module and select Telnet as a medium of transfer.
- When a code is complied, connect the phone's Wi-Fi to the Esp8266 SSID.
- Wait for 20 Seconds from the time of compilation (Delay provided manually in program) and then select the new connection which has just been created by you on the App. If everything is correct you shall see a Blank Black screen on the App.
- If connection is not established properly you will see the following message on the same black screen. "Connecting to "IP Address"...."
- After the successful connection and after 10 seconds you will see the data transfer.
- When checking data transfer on **desktop PC/laptop :**
  - Open Putty
  - Select Logging (Under Session on the left) → All Session Output →Browse the folder

where you want the Logged File to be saved.

- Click Session → Fill in IP Address and Port Number of the module to be connected to → Connection Type – Telnet
- Under the Saved Sessions bar give a name and click on Save to save all the above settings so as to use them in the future again instead of doing all the above steps every time.
- Once code is complied, start the Putty Session and after 20 Seconds you should see the Data Transfer. And after entire file is transferred, close putty and browse to the file where data is logged to get the file. File will not be created until Putty is closed.

Following AT command set was used in the tests:

AT - Test module response

AT+GMR - Module Information

AT+IPR=2000000 - Change the baud rate of the module – (Old Firmware)

AT+UART_DEF=2000000,8,1,0,1 - Change the baud rate of module – (New Firmware)

AT+CWMODE=2 - Change mode of the module 1-3 (1-client,2-Server,3- Server+client)

AT+CIPMUX=1 - Accept multiple connections (0-Single , 1- Multiple)

AT+CIPSERVER=1,80 - Set module as the server

AT+CIPAP="192.168.4.1" - Set the IP Address of the module in Server mode

AT+CIPSTA="192.168.5.1" - Set IP address of module in client mode

AT+CWSAP="DRILL","password",3,2 - Set the SSID and PW of the module

AT+CIPSTAMAC? - Get current MAC address of the module in station mode

AT+CIPAPMAC? - Get current MAC Address of the module in SoftAP mode.

AT+CIPMODE=1 – Put module in Transparent Transmission Mode.

AT+CIPSTART=1,"TCP","ip address","port" (when AT+CIPMUX=1) //doesn't work on new f/w (This command is for the client mode)

AT+CIPSTART="TCP","ip address","port" (when AT+CIPMUX=0)

AT+CIFSR - Get Ip address of module as the client

AT+CIPSEND=0,2048 - Send data packets

IV. EXPERIMENTS

1. ESP8266 with Arduino Uno (Server Mode)

The ESP8266 was first tested with Arduino UNO. The hardware-serial was used as it has dedicated Tx, Rx pins which results in faster communication than the software-serial.

The Following sketch was uploaded in Arduino UNO:

```
#include <SPI.h>
#include <SD.h>
#define TIMEOUT 5000 // mS
#define LED 13
char buf[512];
const int chipSelect = 10;
File myFile;
char invar = 0;
char invar1 = 0;
//-----------------------------------------------
void setup()
{
pinMode(LED,OUTPUT);
Serial.begin(4000000);
/*--------------SD CARD INIT----------------------*/
//Serial.print("Initializing SD card...");
pinMode(SS, OUTPUT);
if (!SD.begin(chipSelect)) {
   return;
  }
SendCommand("AT", "Ready");
SendCommand("AT+CWMODE=2","OK");
Serial.println("AT+CWSAP=\"TFM_DRILL\",\"password\",
3,2");
//SendCommand("AT+CIFSR", "OK");
SendCommand("AT+CIPMUX=1","OK");
SendCommand("AT+CIPSERVER=1,80","OK");
/*----------------FIND IMPORT STRING--------------------*/
String IncomingString="";
boolean StringReady = false;
delay(25000);
StringReady= true;
if (StringReady){
 /*----------------READ FILE IF FOUND IMPORT
STRING---------------------*/
  myFile = SD.open("DATA50.TXT");
 if (myFile)
  {
    while (myFile.available())
    {
     Serial.println("AT+CIPSEND=0,512");
     while(1){
       if(Serial.find(">")){
         invar = 1;
        }
       if(invar == 1) break;
       }
     myFile.read(buf,512);
     Serial.write(buf,512);
     while(1){
       if(Serial.find("OK")){
         invar1 = 1;
        }
       if(invar1 == 1)
       break;
       }
     invar = 0;
     invar1 = 0;
    }
    myFile.close();
  }
 else
  {
    Serial.println("error opening test.txt");
  }
 }
}
/*-------------------------LOOP---------------------*/
void loop(){
}
```

```
/*-------------------FUNCTIONS-------------------------*/
boolean SendCommand(String cmd, String ack){
 Serial.println(cmd); // Send "AT+" command to module
 if (!echoFind(ack)) // timed out waiting for ack string
   return true; // ack blank or ack found
}

boolean echoFind(String keyword){
byte current_char = 0;
byte keyword_length = keyword.length();
long deadline = millis() + TIMEOUT;
while(millis() < deadline){
 if (Serial.available()){
   char ch = Serial.read();
   //Serial.write(ch);
   if (ch == keyword[current_char])
     if (++current_char == keyword_length){
      //Serial.println();
      return true;
   }
  }
 }
return false; // Timed out
}
/*--------------------END OF FUNCTIONS------------------*/
```

For this setup, 1Mb file took 35 Seconds to transfer. The limitation of this setup was the memory size. Due to this we could only send buffered data of maximum 512 characters. This caused added cycles of the loop in the program which increased the processing time which ultimately resulted in fairly slow transfer speed.

2. ESP8266 with Arduino Mega (Server Mode):

To solve the above limitation in the case of Arduino Uno, we switched to Arduino Mega which has more memory than the Uno. The Mega could handle large buffer size and so could increase the transfer speed.
We made some changes in the code which was used in the Arduino UNO. The buffer size which was 512 bytes in the Arduino UNO was made 2048 bytes in the Arduino Mega. The Mega, could handle large amount of data in a single go. Also, the Serial baud rate was increased to 5000000 from 4000000.
For this setup, 1Mb file took 15 Seconds to transfer. Transfer time is significantly improved as now we are sending data in block sizes of 2048 which is the maximum sending size for the ESP8266.

3. ESP8266 with Teensy 3.2 (Server Mode)

Finally we tested the ESP8266 with the Teesny 3.2 which is way faster than the Arduino Uno and Mega. Also, it has more memory than the other two.
In this setup, 1Mb data took 5 Seconds to transfer. This was the fastest time achieved amongst the 3 methods. We are sending data at the maximum baud rate of 5 Million and maximum buffer size of 2048.

4. ESP8266 with Teensy (Client Mode- Python Server)

The connection for this setup is same as the server mode. The only difference here is that we configure the ESP module in client mode and send data through the Transparent Transmission mode of the module. For the server we use a script which is written in Python.

Python Server Sketch:

```
import socket               # Import socket module
import time
s = socket.socket()         # Create a socket object
host = '192.168.0.119' # Get local machine name
port = 80                   # Reserve a port for your service.
s.bind((host, port))        # Bind to the port
f = open('Got_File.txt','wb')
s.listen(5)                 # Now wait for client connection.
while True:
   c, addr = s.accept()     # Establish connection with client.
   print ('Got connection from', addr)
   start_time = time.time()
   print ("Receiving Data from Client...")
   l = c.recv(1024)
   while (l):
      print ("Receiving...")
      f.write(l)
      #print (l)
      l = c.recv(1024)
   f.close()
   #s.shutdown(socket.SHUT_WR)
   print ("Done Receiving")
   print("--- %s seconds ---" % (time.time() - start_time))
   c.send("Thank you for connecting")
   c.close()
/********** End of Code**********************/
```

For this setup, 1Mb file took 3 minutes to transfer. Work is still underway on this setup. We need to reduce the transfer times as the current results are not ideal for us. So we are still sticking with the results we got using the “ESP with teensy – Server Mode”.

V. RESULTS

Following are the final and best results that we have achieved from all scenarios and setups.

Arduino Uno and ESP:
Server Mode:

Baud Rate: **4 Million**	Buffer Size: **512**
File Size: **1Mb**	Time: **35 Seconds**
File Size: **8Mb**	Time: **2 Minutes 30 Seconds**
Data Integrity: **100%**	

Arduino Mega and ESP:
Server Mode:

Baud Rate: **5 Million**	Buffer Size: **2048**
File Size: **1Mb**	Time: **15 Seconds**
File Size: **8Mb**	Time: **2 Minutes**
Data Integrity: **100%**	

Teensy and ESP:
Server Mode:

Baud Rate: **5 Million**	Buffer Size: **2048**
File Size: **1Mb**	Time: **4 Seconds**
File Size: **8Mb**	Time: **35 Seconds**
Data Integrity: **100%**	

Teensy and ESP:
Client Mode: Python Server: Transparent Transmission Mode

Baud Rate: **2 Million**	Buffer Size**: No Buffer**
File Size: **1Mb**	Time: **3 Minutes**
File Size: **8Mb**	Time: Not Tested
Data Integrity: **100%**	

VI. CONCLUSION

Performing several experiments on ESP8266 and various Microcontrollers, we came to a conclusion that the large amount of data can be transferred using the ESP8266 Wi-Fi module along with the teensy 3.2 in a small amount of time. Thus, the need of the wireless transfer of data from an external sd card to the Android device or the desktop PC can be fulfilled by the use of Wi-Fi module as a communication medium.

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An investigation of the durability and compressive strength of air cured microconcretes containing different types of aggregates

Apostolos S. Marinos, John A. Marinos

***Abstract*— This paper investigates how the type of aggregates affects the compressive strength of concrete and also its durability against chloride penetration and carbonation. Microconcretes (concrete without coarse aggregates) contained different types of sand (sand from crushed limestone, river silica sand) were produced. Water–to–cement (w/cm) ratios of 0.35, 0.4 and 0.5 were used in production of microconcretes. The durability of microconcretes against chloride penetration was tested with Rapid Chloride Permeability Test (RCPT) method. Also, the carbonation of microconcretes determined by means of phenolphthalein indicator and the compressive strength of microconcrete specimens was tested according EN 196 – 1. Tests results revealed that the types of sand (aggregate) that were used in this study affect equivalently the properties of microconcrete, like compressive strength and durability. Also it can be concluded from the test results that w/cm ratio affect critically the properties of microconcrete. Finally, from the correlation between chloride permeability results and electrical conductivity of microconcretes it can be concluded that electrical conductivity measurements can be used as a rapid and non-destructive method to estimate concrete resistance against chloride penetration.**

***Index Terms*—Air Curing, Carbonation, Chlorides, Compressive Strength**

I. INTRODUCTION

Reinforced concrete is the most widely used composite material in structural practices due to ease in applications and low cost of construction. However, the service life of these structures can be affected critically by a number of environmental conditions [1]. The majority of concrete deterioration cases is connected to reinforcement corrosion due to carbonation – or chloride – induced depassivation of steel bars [2]. The chloride ions and carbon dioxide, which can be found in high concentrations in various environments, when they penetrate into concrete matrix, they can cause corrosion of the reinforcement, which leads to premature deterioration of concrete structure [3]–[14]. Therefore, it can be said that the resistance of concrete against chloride penetration and carbonation has an important effect on its durability and hence on a concrete structure's service life [15]–[17].

The main constituents of concrete are: Cement, Water, Coarse and Fine Aggregates. Although the basic properties and characteristics of concrete are mainly affected by the type of cement and cement hydration products, aggregates must also be considered as an important constituent of concrete. Due to the fact that the aggregates occupy about 60 – 70% per cent of the volume of concrete, their impact on various characteristics and properties of concrete is undoubtedly considerable [18]–[20].

In this study, microconcretes (concrete without coarse aggregates) with different aggregate type (sand from crushed limestone, river silica sand) were produced and their compressive strength and durability against chloride penetration and carbonation was studied, in order to investigate the effect of aggregate type on concrete properties. The effect of w/cm ratio on concrete properties was also studied. Finally, the electrical conductivity of microconcretes was estimated from Rapid Chloride Permeability measurements.

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II. EXPERIMENTAL PROGRAM

A. Materials

The materials used in this study were Portland-composite cement (CEM II / B–M (P-W) 42.5N according EN 197-1), potable water according EN 1008:2002, two types of fine aggregates (limestone sand, river sand) and superplasticizer. The chemical composition and the physical properties of cement and sands are given in Table 1. Fig. 1 presents the Particle Size Distribution (PSD) of cement and Fig. 2 the PSD of limestone sand and river sand. The PSD of cement was defined with Static Laser Light Scattering (SLS) method with a CILAS – 1064 Particle Size Analyzer. The PSD of sands was determined according to ASTM C 136 – 06. A chloride free, polycarboxylate based superplasticizer (SP) (Sika® ViscoCrete® – 300) was employed to achieve the desired workability in all mixtures.

B. Mix proportions and sample preparation

Six different microconcrete mixtures were designed and prepared in this study. The mixture proportions are presented in Table 2. As it is presented in Table 2, microconcretes A, B and C contained limestone sand as aggregate, while microconcretes D, E and F contained river sand as aggregate. Initially, the dry materials were mixed together at low mixer speed and then water and superplasticizer were added. Superplasticizer was added at the time of mixing, in order to keep flow table (EN 1015-3:1999) values in the range of 190 ± 5 mm for all mixtures.

Table 1 Chemical composition and physical properties of cement and sands

	CEM II 42.5N	Limestone Sand	River Sand
	(%)	(%)	(%)
SiO_2	22.1	-	97.8
Al_2O_3	6.27	-	0.85
Fe_2O_3	3.55	0.02	0.17
CaO	55.97	55.5	0.1
MgO	2.2	0.72	0.28
K_2O	0.71	0.01	0.65
Na_2O	0.3	-	-
SO_3	3.1	-	-
TiO_2	0.31	-	0.035
LOI	5.23	43.52	0.2
Blaine (cm^2/g)	**4461**	-	-
Sp. Gravity (g/cm^3)	**2.96**	**2.7**	**2.6**
Cement Compressive Strength according EN 196 – 1 (MPa)			
2 days	**28.9**		
7 days	**40.4**		
28 days	**50.7**		

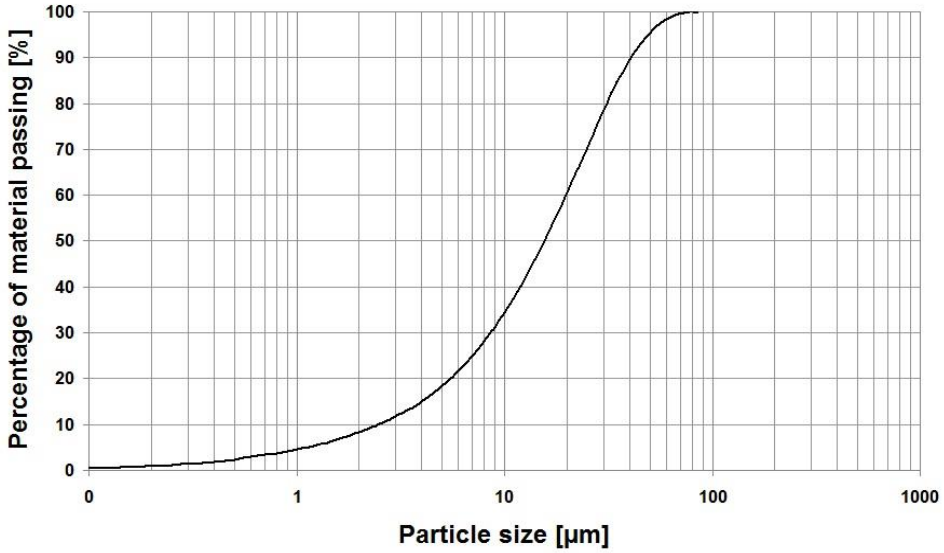

Fig. 1 Particle Size Distribution of CEM II 42.5N

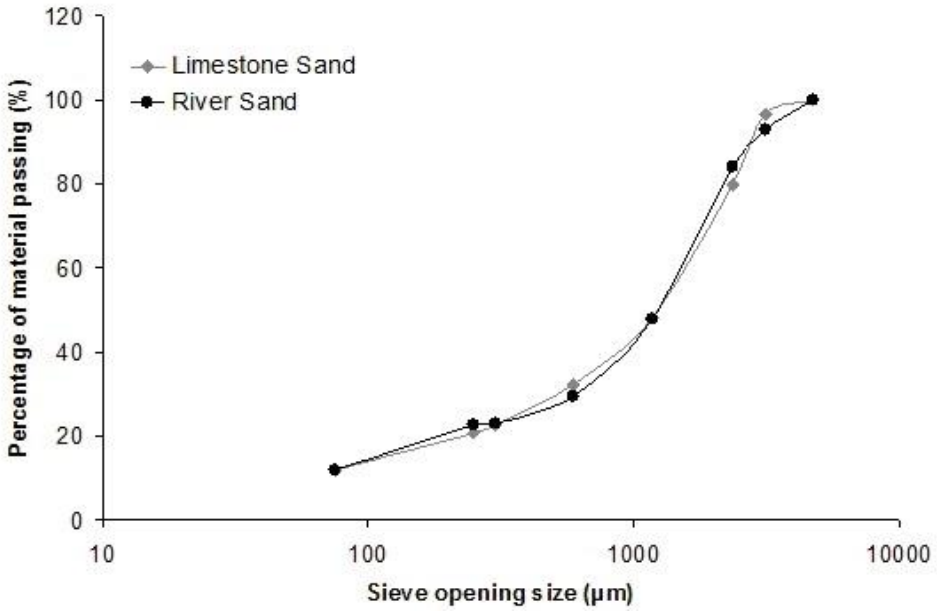

Fig. 2 Particle Size Distribution of sands

Table 2 Microconcrete mixture proportions

	Limestone sand			River sand		
Mixture	**A**	**B**	**C**	**D**	**E**	**F**
Materials	**kg/m^3**			**kg/m^3**		
CEM II 42.5N	496	519	532	487	507	521
Water	248	207	186	244	203	182
Sand	1488	1556	1597	1462	1522	1563
SP	3.7	6	7.6	3	6	7
w/cm	**0.5**	**0.4**	**0.35**	**0.5**	**0.4**	**0.35**
Flow Table (mm)	190	186	187	195	192	186

Prismatic specimens with dimensions 40 x 40 x 160 mm and cylindrical specimens with dimensions Φ150 x 300 mm were cast for each mixture. Prismatic specimens (Fig. 3) were cast according to EN 196-1. Cylindrical specimens (Fig. 4) were cast in steel moulds and compacted with a vibrating table.

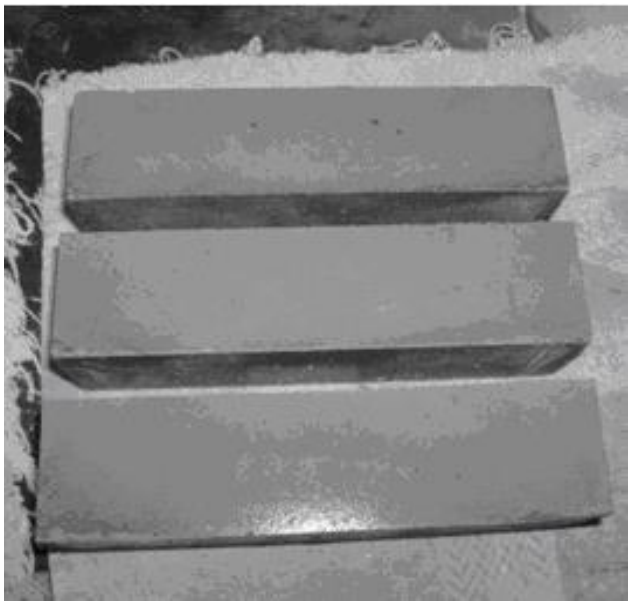

Fig. 3 Prismatic specimens (40 x 40 x 160 mm)

Fig. 4 Cylindrical specimens (Φ150 x 300 mm)

C. Curing

After casting, the cylindrical specimens were covered with a wet blanket to minimize water evaporation and cured under laboratory conditions for 24 hours. The prismatic specimens were covered with a plastic sheet and cured in a humidity chamber for 24 hours. After 24 h, all specimens were demoulded and left to cure under laboratory conditions (Air Curing - *Temperature: 19 – 23^{o}C, Relative Humidity: 55 – 70%*).

III. Test Methods

A. Compressive strength

The 40 x 40 x 160 mm microconcrete specimens were used for compressive strength measurements. Compressive strength was determined according to EN 196 – 1 [21]. For each mixture and at each curing age (28, 90, 180 and 360 days), three specimens were tested and the mean value of these measurements is reported below.

B. Chloride Permeability

The chloride permeability of microconcrete specimens was estimated according ASTM C 1202 [22]. This method, also called Rapid Chloride Permeability Test (Fig. 5), can be used to estimate the resistance (durability) of concrete against chloride penetration. The durability of concrete against chloride penetration is crucial for concrete structures' service life, since chlorides, when they reach the reinforcement, can cause corrosion, which leads to concrete deterioration and finally failure of the structure.

The chloride permeability of microconcrete specimens measured after 28, 90, 180 and 360 days of curing. In order to measure the chloride permeability of microconcrete specimens, cylindrical specimens with dimensions Φ95 x 50 ± 1 mm prepared (Fig. 6). First, a Φ95 x 300 mm core sample was drilled from each Φ150 x 300 mm cylindrical specimen, after seven days of curing. A 20 mm width slice was cut from the top of each core sample, in order to avoid possible inhomogeneities of the upper part of microconcrete specimens due to compaction. Then the core samples were cured under laboratory conditions until the test day. Finally, a 50 ± 1 mm width slice was cut from each core sample with a water cooled diamond saw and used to measure the chloride

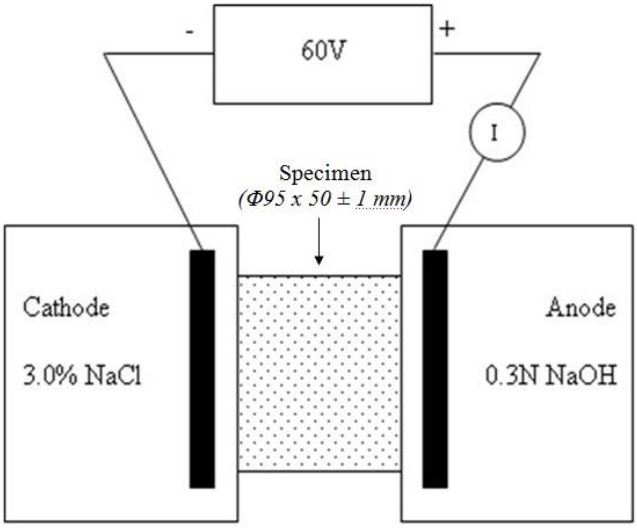

Fig. 5 Schematic diagram of Rapid Chloride Permeability Test

Fig. 6 A Φ95 x 50 ± 1 mm cylindrical specimen

permeability of microconcretes after specific curing periods. By applying a potential of 60V of direct current and measuring the quantity of electrical charge (Coulomb (*Cb*) passing through a Φ95 x 50 ± 1 mm specimen, we can estimate microconcrete durability against chloride penetration.

Fig. 7 A cylindrical specimen with dimensions Φ150 x 300 mm prepared for carbonation testing

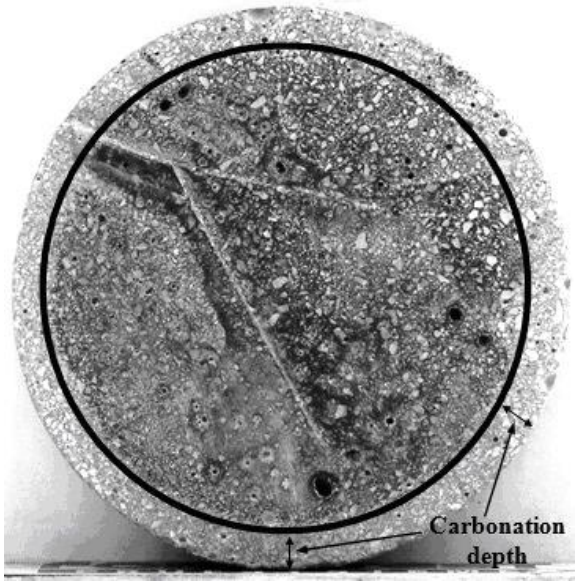

Fig. 8 Carbonation depth measurement

C. *Accelerated carbonation testing*

After curing under laboratory conditions for 5 days, two cylindrical specimens of each mixture (Φ150 x 300 mm) were placed in a chamber with controlled concentration of CO_2 (22 - 23%). The relative humidity inside the chamber was 55–70%. The bottom and top surface of the cylindrical specimens were sealed in order for CO_2 to penetrate through cylindrical surface (Fig. 7). After specific CO_2 exposure periods, a 20 mm width slice was cut from each cylinder with a diamond saw and the carbonation depth was determined by means of phenolphthalein indicator (Fig. 8).

IV. Results and Discussion

A. *Compressive strength results*

The compressive strength of microconcrete specimens contained limestone sand and microconcrete specimens contained river sand is presented in Fig. 9 and Fig. 10 respectively. From compressive strength results it can be concluded that for all w/cm ratios, microconcrete specimens with limestone sand and microconcrete specimens with river sand show similar compressive strength.

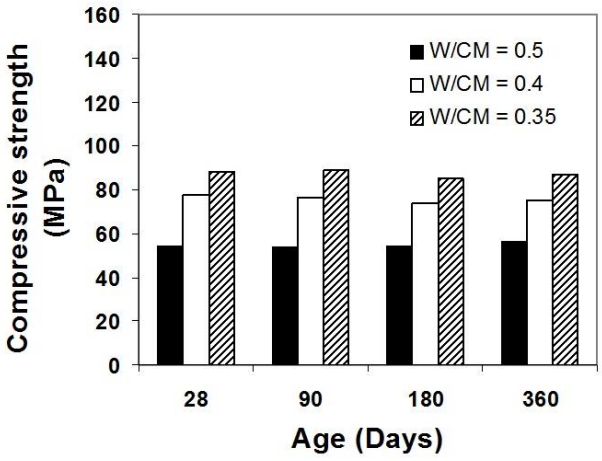

Fig. 9 Compressive strength of microconcrete specimens contained limestone sand

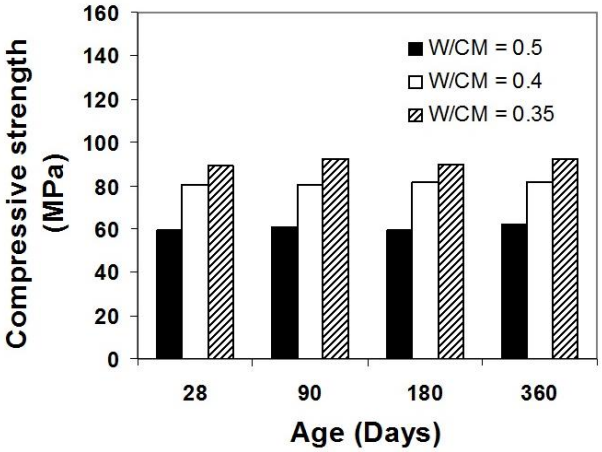

Fig. 10 Compressive strength of microconcrete specimens contained river sand

Also, comparing the values of compressive strength for different w/cm ratios, it can be concluded that the lower the w/cm ratio, the higher the compressive strength. A low w/cm ratio leads to a more dense microstructure and therefore to higher compressive strength.

B. Chloride permeability results

The value of electrical charge passed through microconcrete specimens during chloride permeability measurements is presented in Fig. 11 and 12. It can be observed from the results presented in Fig. 11 and 12 that for all three w/cm ratios, microconcrete specimens contained limestone sand show similar chloride ion permeability with microconcrete specimens contained river sand, for all four curing ages. Comparing the electrical charge values, it can be concluded that microconcrete specimens contained limestone sand and microconcrete specimens contained river sand show equivalent durability (resistance) against chloride ion penetration. Also, comparing the values of electrical charge for different w/cm ratio, it can be concluded that when the w/cm ratio is high (w/cm = 0.5), microconcrete specimens show high chloride permeability.

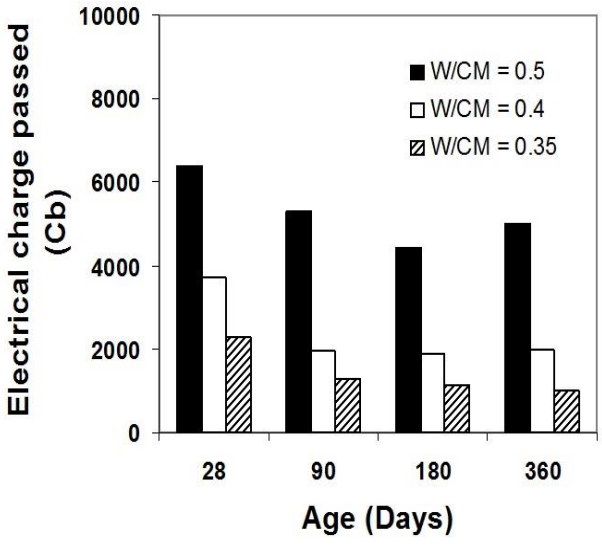

Fig. 11 Electrical charge passed through microconcrete specimens contained limestone sand

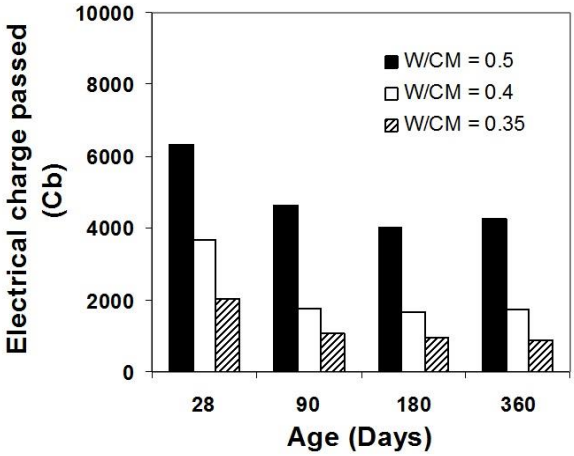

Fig. 12 Electrical charge passed through microconcrete specimens contained river sand

On the other hand, when the w/cm ratio is low (w/cm = 0.35), microconcrete specimens show low chloride permeability. A low w/cm ratio leads to a dense and less porous microstructure. Therefore, microconcrete specimens with low w/cm ratio show higher resistance against chloride penetration, compared to microconcrete specimens with high w/cm ratio.

C. Accelerated carbonation results

In order to estimate the carbonation of microconcrete specimens contained different types of sand, Φ150 x 300 mm cylindrical specimens were exposed to CO_2 for four different periods. The results of accelerated carbonation measurements are presented in Fig. 13 and 14. It can be observed from Fig. 13 and 14 that microconcrete specimens contained limestone sand and microconcrete specimens contained river sand show similar carbonation for all four exposure periods. Therefore it can be concluded from Fig. 13 and 14 that microconcrete specimens contained limestone sand and microconcrete specimens contained river sand show equivalent durability against CO_2 penetration. Also, from Fig. 13 and 14 it can be concluded that when the w/cm ratio is high (w/cm = 0.5), microconcretes show high carbonation depth. On the other hand, when the w/cm ratio is low (w/cm = 0.35), microconcretes show low carbonation depth.

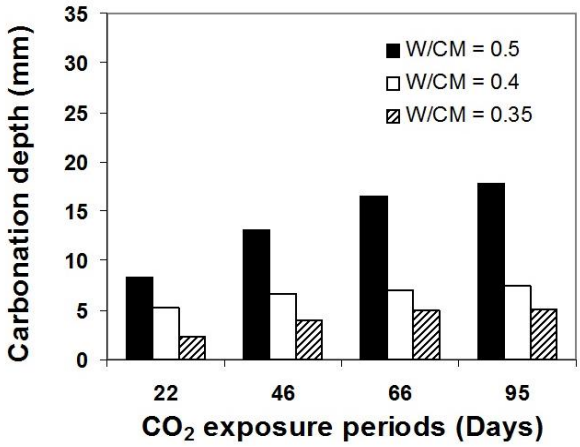

Fig. 13 Carbonation depth of microconcrete specimens contained limestone sand

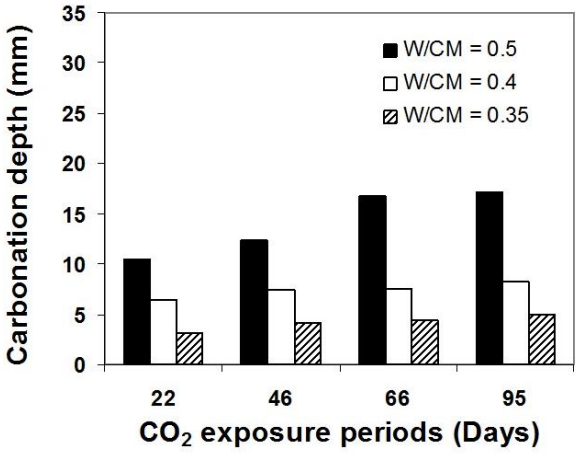

Fig. 14 Carbonation depth of microconcrete specimens contained river sand

Microconcretes with low w/cm ratio develop a dense and less porous microstructure. Therefore, microconcretes with low w/cm ratio show higher resistance against carbonation, compared to microconcretes with high w/cm ratio.

D. Correlation between w/cm ratio and electrical charge

Fig. 15 and 16 show the correlation between w/cm ratio and electrical charge passed through microconcrete specimens that cured under laboratory conditions for 28 days.

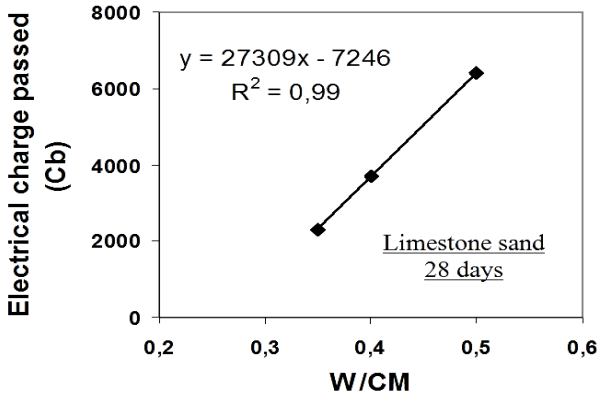

Fig. 15 Correlation between w/cm ratio and electrical charge

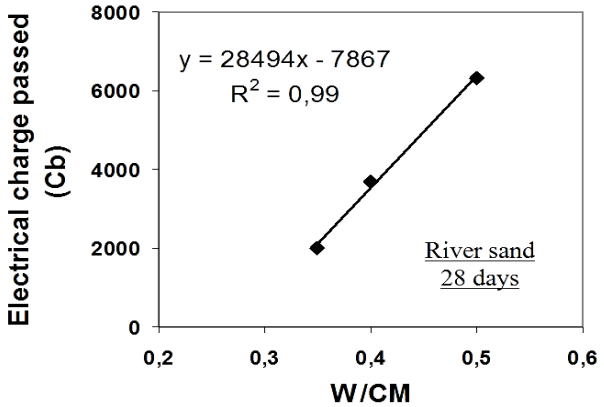

Fig. 16 Correlation between w/cm ratio and electrical charge

It can be observed from Fig. 15 and 16 that there is a high linear correlation (R^2 = 0.99) between w/cm ratio and the electrical charge passed through microconcrete specimens. Therefore, it can be concluded from Fig. 15 and 16 that w/cm ratio affects significantly and in an immediate way the durability of concrete against chloride penetration. The linear correlation between w/cm ratio and electrical charge passed through microconcrete specimens cured for 90, 180 and 360 days show similar regression results ($R^2 > 0.95$).

E. Correlation between w/cm ratio and compressive strength

Fig. 17 and 18 show the correlation between w/cm ratio and compressive strength of microconcrete specimens that cured under laboratory conditions for 28 days. It can be observed from Fig. 17 and 18 that there is a high linear correlation (R^2 = 0.99) between w/cm ratio and compressive strength of microconcrete specimens. Therefore, it can be concluded from Fig. 17 and 18 that the compressive strength of concrete can be affected crucially and in an immediate way from w/cm ratio. The linear correlation between w/cm ratio and compressive strength of microconcrete specimens cured for 90, 180 and 360 days show similar regression results ($R^2 > 0.95$).

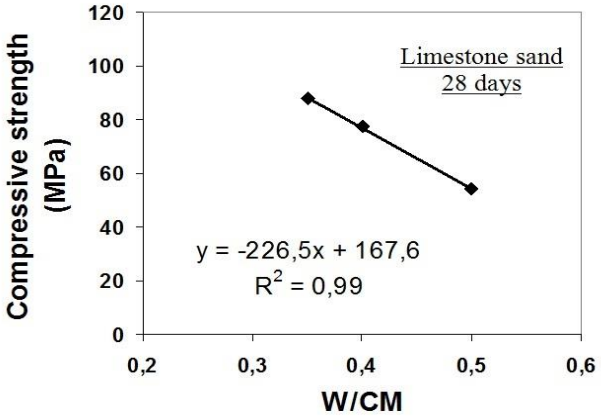

Fig. 17 Correlation between w/cm ratio and compressive strength

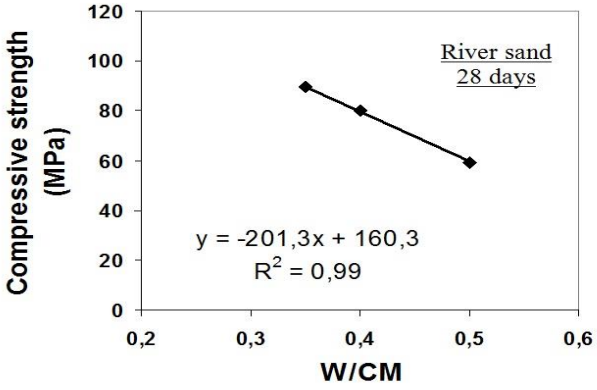

Fig. 18 Correlation between w/cm ratio and compressive strength

V. Electrical Conductivity

The results of electrical conductivity measurements can be used as an indication of concrete microstructure permeability properties. It has been reported in literature [23]–[26] that electrical conductivity (σ) measurements can be used as a non-destructive method for estimation of concrete durability against chloride penetration. In this study, the electrical

conductivity calculated from ASTM C 1202 chloride permeability measurements, using (1):

$$\sigma = \frac{I_o * L}{A * V} \quad (1)$$

where

- σ: Electrical conductivity (S/m)
- I_0: The initial current that was measured at the beginning of chloride permeability measurements (Ampere)
- L: Specimen's thickness (m)
- V: The applied voltage (Volts)
- A: Specimen's exposure surface to chlorides (m^2)

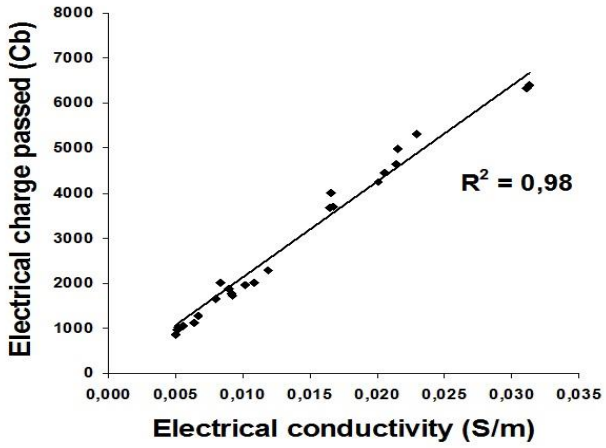

Fig. 19 Correlation between electrical conductivity and electrical charge passed through microconcrete specimens

A high linear correlation (R^2 = 0.98) is observed between electrical conductivity and electrical charge passed for all microconcrete specimens (Fig. 19). From Fig. 19 it can be concluded that electrical conductivity measurements can be used to investigate the durability of a concrete against chloride penetration, since, as Fig. 19 shows, a concrete with low electrical conductivity will show greater durability against chloride penetration.

VI. Conclusions

Based on the findings of the experimental program presented above, the following conclusions can be drawn:

- ❖ Microconcretes with limestone sand and microconcretes with river sand show equivalent compressive strength and equivalent durability against chloride penetration and carbonation.
- ❖ The w/cm ratio affects significantly the compressive strength, the chloride permeability and carbonation of microconcretes. Low w/cm ratio leads to a more compact and less porous microstructure and therefore to higher compressive strength and greater durability against chloride penetration and carbonation.
- ❖ Electrical conductivity measurements can be used as a rapid and non-destructive method to estimate concrete durability against chloride penetration.

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Enhancing Security Information and Event Management to Develop Future-Ready Security Operations Center

Steffi Raju

***Abstract*— The threats to the security of networking systems are on the rise. This had led to a continued need to implement effective monitoring of the events and the activities over the information network infrastructure via the Security Operations Center (SOC). It is in this context that Security Information and Event Management (SIEM) gains prominence. SIEM is a network monitoring technology for facilitating real time network monitoring for the Insider threats within a given organization's SOC. It analyses not just the current security events but also evaluates these incidents with historically archived security log data to identify patterns in security threats and to help security architects make the underlying architecture more robust. The aim of this study is to enhance the existing SOC setup by incorporating new enhanced architecture and working procedures. It also aims to automate the testing and analysis of standard security controls using SIEM. All the above developments would help create a future-ready SOC which would greatly strengthen the overall IT security landscape of an organization.**

***Index Terms*— ISO 27001 Security Controls, Security Operations Center, Security automation, SIEM.**

I. INTRODUCTION

Information security is a buzzword in the global IT landscape and is one of the most critical component in an organization. Nowadays, hackers are very advanced in their approach to break organizational information security and sophisticated mechanisms are being utilized to compromise the security over the network in the IT systems. These mechanisms are being launched either from within the network (internal threats) or from outside the network [1]. Previously organizations were passive responders to the threat and used to only react as an when a security breach occurred. However the deep financial, reputational and operational impact of cyber-attacks have prompted organizations to Computer Security Incident Response Teams (CSIRT) teams working as part of Security Operations Center (SOC). These centers proactively monitor security incidents in real time and take requisite action as and when vulnerability is identified by them. Security Information and Event management (SIEM) technology has been extensively deployed as part of SOCs to assist in the whole data collection and analysis process.

SOC has its role to implement the application of the SIEM technology so as handle the enterprise level security. SIEM performs the correlation on the log information and the network's events in order to manage the risks over the network attacks. It helps in tracking the possible threats in the network; and it usually does so during the real time events. The effectiveness of the application of the SIEM technology in the monitoring of the networks threats depends on the ability detect the origin of the attacks or threats. Thus the Insider threats are usually in the network pool, where the organization's network users- managers, workers or the supervisors access sensitive information over the network.

It helps to consolidate and thereby evaluate messages and alerts originating from different IT systems in a centralized platform[2]. The SIEM systems are effective as they can comprehend large amounts of the security data and provide the raw data in a visual form which is comprehensible to the end-user [3]. Visualization is thus an essential part of the SIEM systems. Overall, SIEM help in evaluating the security of computer networks in a real-time or near real-time basis by monitoring security incidents thereby mitigating risk of information leakage due to the security gap [4].

Security logging is an old concept and has been implemented in organizations for quite some time now. However, in a multi-system enterprise environment a security logging mechanism would not be effective if the data produced time consuming to go through and complex to interpret. It is in this context that the quality data is important than the quantity of data produced[5]. SIEM enables to collect, store, find correlation, analyze the complete logs and present it to in a meaningful manner to the end-user.

The current setup of SIEM requires considerable human effort in monitoring security incidents. This can become overwhelming for CSIRT team if the IT landscape is large and varied. Further the incident detection methods also rely upon singular metrics rather than a combination of multiple metrics. Furthermore, the standard security controls testing set in place via compliance standards like ISO 27001, etc. are also manual in nature. Considerable research has been done in each of the above areas. However, existing research has not integrated all the developments in a single platform. The aim of this study is to synthesize all the existing developments in the field of SIEM into an integrated framework which would help to develop a proactive and automated future-proof SOC system. The method of research is literature review based.

The study would singularly focus on the different cores of the SIEM concept and would help identify the enhancements in each domain. It would first look at the concept of SOC and SIEM and what is the need for such an application. It would then delve into the SIEM architecture and how it can be enhanced to make it more effective. Following this, it would focus on the inner working of SIEM in identifying security

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incidents and would propose improvements to the detection process. Once these two parts are done, it would suggest ways to automate standard security controls testing using SIEM. In the end, the study aims to provide a standard set of requirements for all SIEMs to have in order to develop a robust SOC.

II. THEORETICAL FOUNDATION

In order to understand the concept of SOC and SIEM, it is essential to understand the foundation behind it. This section aims to provide the brief overview of both concepts and what is the motivation behind implementing them in organizations. It also explains the architecture of SIEM and the background of how security evaluation of an attack is identified and evaluated in SIEM presently.

A. Security Operations Center (SOC)

A SOC is a centralized unit security monitoring unit in an organization which monitors security incidents on a real-time basis. It monitors the security events around the IT assets including network, firewalls, intrusion detection/prevention systems, application servers, database systems and lastly user accounts in an organization[6]. Each of the above assets are monitored constantly and SOC receives periodic logs which are then analyzed for any security incidents. It also proactively flags malicious events on a real-time basis which allows CSIRT teams to swiftly react and defend the infrastructure from attacks.

The effectiveness of SOC depends heavily on its analytical and forensic abilities and how quickly it can analyze the data and report events back to end-users [6]. This requires an in-depth understanding of the entire IT infrastructure in order to perform correlation analysis. SOC is able to perform all the logging and monitoring due to SIEM systems which are integral to it.

B. Security Incident and Event Management (SIEM)

As mentioned in previous section, SIEM forms the inner core of the SOC architecture. As the name suggests, SIEM is a combination of Security Information Management (SIM) and Security Event Management (SEM). SEM performs data aggregation of the security logs in management information. It then creates security incidents which are tackled by the CSIRT. While SEM focuses on data aggregation, SIM on the other hand focuses on analyzing historical data and performing trend analysis on them to identify trends. These trends would help SIEM to flag events even before their occurrence, thereby improving the long-term effectiveness of information security systems [5].

SIEM help to consolidate and evaluate messages and incidents from individual systems components in a timely manner. They collect logs from disparate sources and normalize them into common standard representation. They further store these event in their rule engine which then send alerts once a rule is activated[6]. These security alerts are not only specific to single applications but can perform correlation analysis which makes it integrated across the complete IT platform. However all the advance in SIEM has led to an exponential increase in the number of security incidents. This, as per past experience in multiple organizations have shown that SIEM systems are complex to operate and require high resource effort to analyze all events. Thus in long term, security analysts end up neglecting SIEM systems on an operational level [2].

C. SIEM Architecture & Working

A typical SIEM infrastructure has the below mentioned six core components as is described by [7]:

a. Source Device: The source systems are the data sources that provide security runtime logs from the components within the entire enterprise infrastructure. It can be anything from application servers to firewalls, databases, IDS/IPS systems, etc. Since different systems have different syntax in data storage, the logs are made interoperable by SIEM.

b. Log Collection: The logs from the data sources are collected by SIEM by one of the two techniques of PUSH or PULL. Push technique involves logs being proactively pushed by data sources into SIEM on a real-time basis, whereas PULL technique involves SIEM pulling data from source device on a periodic basis. PULL technique is safer as SIEM then understands what kind of data is collected.

c. Normalization: The normalization engine is one of the most important component of SIEM. Different source devices lead to different syntax of log files for every source device. In order for these logs to be analyzed in correlation to each other, it is important for them to be normalized into a standard format. Normalization ensures that the original data from source devices are standardized to a common format.

d. Rule/Correlation Engine: It consists of the rule and correlation engines. The rule engine is a repository of all the rules that are required to evaluate specific security events. A rule engine evaluates logs in the 'what-if' format which usually returns a Boolean value. While rule engines are the repositories for storing rules, correlation engines are the analytical backbone of SIEM. Based on the defined rules, the correlation engine analyzes log data to identify patterns of security events. Most attack types are not simple in order to be flagged on basis of specific rules. Correlation engines analyze the logs in the context of the entire infrastructure and thereby correlate events to flag the correct security events. Correlation engines use Artificial intelligence to reduce the false-positives increasing the efficiency of the event detection [7].

e. Data Storage: Data storage involves storage of both security logs along with the storage of SIEM related data. This data is critical in order to perform historical trend analysis along with maintaining the audit logs for future security audits [7].

f. Monitoring: Monitoring allows the SIEM administrators to interact with the application in order to access the data and also to independently analyze the data. This is normally a visually front-end for visualizing data in a more compact and comprehensible manner.

D. SIEM Attack modeling security evaluation

In order to identify security incidents, SIEM solutions use multiple evaluation techniques to evaluate and identify incidents in a real-time and accurate manner. They help to find and correct gaps in the network configuration, reveal possible security attacks actions for different security vulnerabilities, determine the critical network resources thereby choosing an effective security policy and mechanisms appropriate to current threats [8]. There are many approaches and algorithms for identifying threats such as malefactor's behavior, generating a common attack graph,

calculating different security metrics and providing risk analysis procedure [8].

III. ENHANCEMENTS TO SIEM FOR A ROBUST SOC

Having explained all the concepts around SIEM, this section aims to propose the enhancements which would help to develop a robust future-proof SOC infrastructure. Raydel et al. mention the main challenges that IT security professionals face in the security setup of their organizations[9]. The critical technical challenges outlined by Raydel et al. are listed below [9]:

a. Variety of Source devices to secure: In a diverse IT landscape with multiple applications performing specialized tasks, it becomes challenging to ensure security of all applications. It is complicated to analyze basis the results in SIEM to ascertain the security changes required for different applications in a consistent and standard manner [9].

b. Quick Response to new threats: CSIRT members need to ensure that security vulnerabilities identified within SIEM are plugged quickly before they are exploited by hackers. This would mean a variety of security measures like installing system patches to big changes like re-configuring the security parameters of the application. These are time-consuming tasks and a quick response is not always possible.

c. Lack of interoperability and integration of security tools: There is no standard tool which addresses all the security requirements of an organization. Teams have to rely on multiple security tools, each with their own distinctive format and usage requirements to get all corners covered in the security infrastructure.

In view of the above challenges, it is essential to create a single standardized solution which eliminates the challenges and provides a robust solution to the security needs of any organization. This study proposes a three-staged approach in enhancing the SIEM solution. The three stages are mentioned below:

A. Implementation of Distributed SIEM architecture

Conventional SIEM architecture as described in above section is a centralized architecture with six components. This architecture becomes very difficult to management in a large organization. One of the main challenges in a centralized architecture is the problem of log maintenance. A large number of source devices can lead to large volume of logs generated from numerous sources which are inconsistent in content, format, timestamp, etc. [10]. SIEM greatly reduces the impact of the challenge by normalizing the data. However, the primary of large volume of logs still remains unsolved. In order to solve this problem, the SIEM architecture has to be decentralized and distributed as per the 'Hierarchical Managers Model' outlined by Anastasov et al. in [10]. The 'Hierarchical Managers Model' extends the traditional centralized SIEM architecture by creating a hierarchy of SIEM servers that are connected hierarchically to a central SIEM server. Thus, the central SIEM server acts as a parent node and communicates with the child SIEM servers named 'Child Managers' instead of directly communicating to the source devices for log data[8][10]. The entire process of collecting, normalizing, storing and monitoring of logs is done on the child level and only for data aggregation, correlation and reporting is normalized log data sent to the parent node. Fig. 1 illustrates the architecture of the "Hierarchy Managers Model as proposed by Anastasov et al [10]

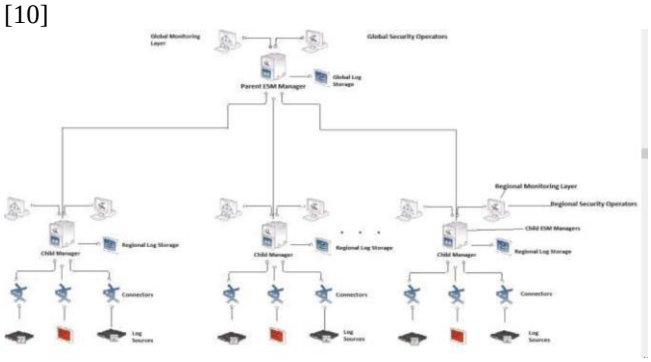

Fig. 1. Hierarchical Managers Architecture by [10]

The main advantage of this architecture is that it introduces the advantages of distributed computing to SIEM. The data management is done by distributing the load across multiple correlation/rule engines thereby reducing the effort at the central node. Only the data for aggregation and correlation which is a subset of the data at the child manager level would be sent to the parent node for analysis thereby reducing load on the central node and thereby increasing the efficiency of their throughput leading to quicker computation times. Along with the SIEMs, the SOCs too needs to be distributed at regional level and only data required for correlation analysis needs to be sent to parent SOC[10]. This also leads to ease of installation and deployment of SIEM systems.

B. Common Framework for Attack Modeling and Security Evaluation in SIEM

One of the challenges outlined by Raydel et al. in [9] is the quicker and accurate response to new threats. The key to a quicker response to new security threats is to accurately pinpoint the threat in the fastest manner. It is in this context that the work of Kotenko et al. finds significance [8]. Conventional security evaluation algorithms rely on one technique for identifying security threats. Kotenko et al. proposed the Attack Modeling and Security Evaluation Component (AMSEC) architecture which uses multiple algorithms in a parallel manner to achieve near to real-time accurate identification of security threats [11]. The techniques proposed by Kotenko et al. as part of the AMSEC architecture for achieving this are mentioned below[8]:

d. Usage of security repository and open security databases containing system and network vulnerabilities, attacks, configuration, weaknesses, countermeasures, etc.

e. Generation of attack trees considering service dependency graphs and zero-day vulnerabilities reports based on Topological Vulnerability Analysis (TVA). In TVA, the graph generator computes the attack scenarios possible due to the vulnerabilities identified in the system. It would be based on both forward and backward analysis in order to cover all combinations of attack sequences. This would help to model critical attack scenarios which when occurred in sequence should be flagged as a possible attack.

f. Application of anytime algorithms to provide near to real-time attack modeling. This would make the system effective to detect vulnerabilities at run-time.

g. Usage of the generated attack graphs to predict possible malefactor's actions: it does this by first creating the attack graphs for the profile of the malefactor selected by the user.

Following this, it would predict the future actions of the malefactor based on its actions.

h. Calculation of a multitude of security metrics, attack and response impacts: Based on the skill level of the malefactor, the system would calculate the various metrics for the impact of possible attack along with the impact of the possible counter-response. The level of counter-response depends on the skill level of the malefactor.

i. Interactive decision support to select the security solutions: In the final step, the AMSEC framework deploys a decision support center which incorporates data from all the above metrics and creates a decision support model which would assist users in taking the appropriate counter-measures based on the severity of the attack.

The AMSEC framework provides a complete rounded platform for computing security incidents. It creates attack graphs which helps to compute all the possible attack scenarios which help in predicting and taking necessary countermeasures to preempt the attack. It would allow for accurate and faster evaluation of system and network security. AMSEC can be integrated into the rule and correlation engines to perform effectively. Coupled with this, the distributed nature of the SIEM would make computations within AMSEC faster, accurate and more manageable.

C. Automate Security Controls testing using SIEM

Until now all the steps mentioned involved proactive involvement of the CSIRT members in the effective working of the SOC. All the above measures coupled with the large and varied IT landscape would make the SOC implementation a very complex and resource-intensive system. To make it financially viable and less resource intensive, the SOC system needs to be made effective by reducing complexity of the overall architecture [9]. This can be done by automating the security controls in the framework as proposed by Raydel et al. in [9]. Security automation as defined by Raydel et al. involves *"the automatic operation and monitoring of security controls by existing hard – and software security tools, reducing human intervention to a minimum"*[9]. According to them, for a security to be automated, it needs to be completely in machine readable format with no requirement for human intervention for decision making. For e.g. security training cannot be automated as it involves the human component. Furthermore, for a system to be automated all the security tools must be managed via a centralized architecture. All these are factors which are the inherent characteristics of the SIEM architecture which thus makes it a prime platform for automating security controls. The security controls are derived from the standard security compliance frameworks like ISO 27001, compliance Audit Guidelines, ISAE SoX standards, etc.

To illustrate the nature of an automated control, consider the A.10.5.1 from ISO/IEC 27001which looks into information backup. Automating this control via SIEM would mean that all the logging and monitoring of backup logs would be automated. Furthermore, in the event of a backup failure, the system would reschedule the backup without human intervention [9]. Raydel et al. have grouped the security controls that can be automated from the ISO 27001 framework and are enumerated below [9]:

a. *Asset inventory (hardware and software):* This control involves maintaining the inventory of all the network components of the organization. SIEM would help to track the inventory, its patch history, version history and installed software within it. It would perform automated patch installations and any deviations from the normal would be analyzed, prioritized and then reported to CSIRT team.

b. *Account management:* This control requires the presence of an Identity and Access Management (IAM) system which creates, modifies, deletes and performs recertification of user and technical accounts on a periodic basis. SIEM can be integrated into the IAM system to automate the monitoring of user accounts activities along with the maintenance of Segregation of Duties (SOD) matrix and automated deletion of accounts on disable.

c. *Log management:* Audit logs record events like network activities, security exceptions, user activities, exceptions, and other events. These logs need to be maintained for forensic analysis and audit reasons. SIEM can automatically collect, aggregate, analyze, correlate and provide proactive security alerts in case of any deviation.

d. System monitoring: This involves proactive monitoring of all information security events and for detection of system attacks. This is the primary task of SIEM as it supports near to real-time analysis of event and also correlate data from multiple source devices.

e. Malware protection: Organizations need to have malware detection systems at the critical entry and exit points in the infrastructure. They should daily check all systems to detect malicious code signatures and alerting the users. SIEM supports malware detection programs and can help in detecting zero-day attacks, backdoors, worms, Trojans, etc. via behavior analysis.

f. Vulnerability scanning and patch management: Organizations must scan their network components for vulnerabilities and must apply security patches on detection of one. SIEM can take it a level further and can automate the complete process. It can also perform correlation analysis based on the vulnerabilities identified and develop attack scenarios for exploiting the vulnerabilities and thereby preemptively stops an attack in its starting stages itself.

g. Security assessment and compliance checking: Organizations need to periodically assess their infrastructure vis-à-vis the compliance standards and industry best practices in order to maintain the most updated security infrastructure. This is done by implementing a configuration monitoring system which would perform remote testing for secure configuration elements. SIEM integration with these scanners would lead to centralized analysis of the system reports and also dynamically alerting any event or incident that would cause non-compliance. SIEM can generate detailed dashboards with evaluation scorecards for tracking these checks.

h. Information backup: As mentioned previously, SIEM can automate the backup process for all workstations in the organization and also take required steps to handle failed backups.

i. Physical security: Physical security is in the context of restricting employees to only those areas of the company to which they need to have access to. Critical environments such as datacenters, development centers, etc. need to be off limits for employees. SIEM can integrate with physical security devices to perform security event analysis. It can alert CSIRT team in case there is a security breach and also identify the target for the breach. This would help in restricting unauthorized malicious access in its starting stages.

j. Incident management: Organizations should implement incident management systems that would effectively track creation of incident ticket for detecting, analyzing, containing the impact, eradicating and recovering the system from a security breach. Integration of SIEM to incident management would lead to creation of incident tickets directly once a pattern of an attack emerges and notifies the CSIRT personnel before the attack reaches its full-maturity. This helps to preemptively stop an attack and take steps to reduce impact of an attack.

Fig. 2. illustrates the implementation of the above mentioned security automation architecture using SIEM as proposed by Raydel et al. in [9]. Currently all the mentioned security controls are managed in separate security applications. SIEM would lead to integration of all systems in a centralized place and help to be a one-stop source for all compliance activities. It would also automate the controls to a greater extent thereby reducing the complexity of the entire architecture. It can also perform correlation analysis across security controls which can lead to attack scenarios being computed from different security issues which otherwise would seem disparate and unconnected. This would make SIEM to become information security hubs to not just automate controls but also centralize all the security controls activities.

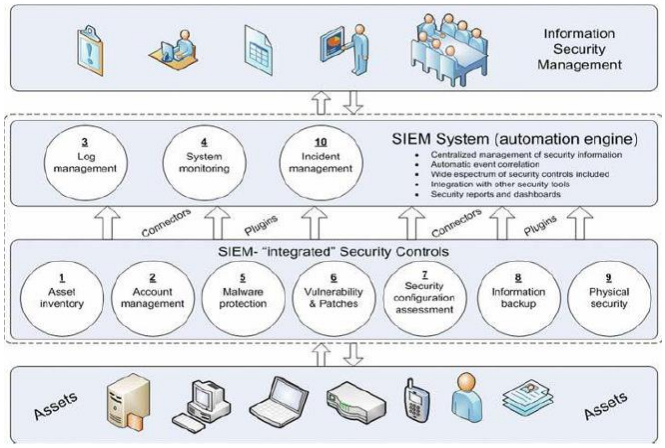

Fig. 2. Security Automation architecture using SIEM by [9]

IV. CONCLUSION

This study looks at the concept of SIEM implemented in organization and proposes a framework for enhancing it in order to build the SOC of future. Security infrastructure has to move beyond the logging activities and look at information retrieval and processing from logs. It needs to evolve from a log-centric approach to a information security data-driven approach. The study proposes a triad of enhancements in the existing SIEM setup. Firstly the SIEM architecture need to move from a centralized processing environment to a distributed computing environment for effective and faster process of security event. It then proposes the revamp of the security metrics calculation and attack graph creation from a single algorithm based approach to a more integrated approach by implementing multiple security calculation techniques in a single architecture. This can be done more effectively using the distributed architecture proposed for SIEM. Once the SIEM architecture and internal working is optimized, the study then proposes to build SIEM as a strategic centralized security monitoring and response application by automating most of the security controls defined within standard compliance standards like ISO 27001.

All these enhancements would help positioning SIEM as a more information processing and security intelligence system rather than a log collection application. There is a great scope for SIEM to develop further thereby creating a robust, less complex and almost automated SOC system.

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A Machine Learning Based Technique for Automating Privacy Settings of Shared Images in Social Site

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***Abstract*— It is well known fact that privacy has being one of the major concerns the photographs that might not want somebody else to see because of our wrong privacy settings might just get into the other peoples timeline. So, in order to avoid this problem of unnecessarily making every photograph as public or publishing the photograph with privacy policy we intend to develop a project which provides content based privacy to the images. Content Based Privacy (content based privacy means that the images is of different types for example**

images containing kids so and so) this images can be identified through image content matching algorithm every image is composed of certain combination of pixels. Each pixel represents certain texture, color, shapes. By properly identify the texture, color, shape of an Image we can find out category of image weather. Whenever we initially start accessing a site our behavior is remembered by the system that means which type of photo that we are sharing with friends, which type of the photo that we are sharing with family and which of the type of photo that we are sharing with everyone.

Based on both metadata that is text information as well as image content that is color, texture and shape then as the user publishes new photograph every photograph will be matched with his previous image content. For example, if we give a new image then it will extract features and matches with the previous one it automatically predicts the policy. Then even if you forget to change the privacy setting of the images this photograph should be easily able to tag this means changing the privacy setting of the image such that only family members or other groups which we want will be able to see without setting each time.

***Index Terms*— Content Based Privacy, Metadata,Content matching algorithm.**

I. INTRODUCTION

Current time we share a lot of photos specifically in the social networking sites like “face book” and “flicker”. Now privacy is one of the major concerns with our photos there are few hobby photos that we take which we want everybody to see for instance, we go out some places we see some sceneries and we post that in “face book”, in “twitter”, ”flicker”. Which we make want all our friends to see whenever there is a new born baby in the family we generally mitigate that photo through “whatsapp” such that our family members are able to see how about the facility is available in almost all social networking. So for example the kids photograph we want to see we want only our family members to see similarly there were few photographs which we want only our college group to see. For example, a group photo taken in the class room, for example we share a study group and we take some photographs of certain notes. We want certain groups to be seen those photographs. In the groups also we might have various interest groups for example, we might be having a group which is say for example, archeological science group which shares and which uses the photo trap of various archeological science now whenever we post a photograph by default it goes to the default privacy setting for different user for different photos user has to select various privacy settings more often or not we tend to forget to set such privacy settings because it is quite a tedious process. We need to select a group, we need to tag a particular group and so and so far content based privacy is used to develop a project.

We can find out the category of the image from the text that we put with the image. for example, somebody posting his new born kids photo will invariably write something like our baby born on so and so date or we are lucky an up to have a baby. So immediately we can understand that the photo is associated with the category called baby or its content is that of the baby of that person. Now as the person keeps on sharing his photographs with some privacy setting at the beginning for example baby’s photo for only family members, for example his classmates photographs only for classmate members for example sports photograph only for group associated with sports for example the photographs of various building with archeological survey group. So once the user starts seeking with privacy at the beginning the project remembers his privacy setting and tries to find out both textual content that means the content that we enter while publishing the photograph as well as the image content in the sense the value of pixel color, the texture value, the shape value so and so. For example, the text contents an image that we associate with an image known as a metadata. Metadata is do not really the data the data is image here metadata is the description of the images. So whenever we initially start accessing a site our behavior is remembered by the system that means which type of photo that we are sharing with friends, which type of the photo that we are sharing with family and which of the type of photo that we are sharing with everyone so as per the image content and data every new image content will be matched. So for example if you try to give a new photograph of a baby from your past data it should be able to automatically tell that this is the photograph of a baby. If you forget to make a setting on each image it automatically predicts the policy each time there is no need to change a setting of privacy large amount of data

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can be uploaded at a time this is the overall project.

II. Literature Survey:

Due to the using of social sites a huge data is being shared on this which is violating the privacy so for this a survey has been done here and to prevent security a semantic annotated hidden Markova model is used to measure the annotated photos similarity in the database [1].To keep security protection in community, images need to be protected through different settings Here a protection of innovation prompt is used to share a data by the user this will fulfill the users end level goal [2].As the leaking of personal data within the friends or some group it is not satisfied to the user so to handle this type of problem a survey has been taken place through which a review is given of different privacy settings for the user to satisfy their level [3].To provide security to the image and shared data Images which are to be published System automatically annotates the image using hidden Markova mode and features are extracted [4]. Uploading a photos in the content sharing sites may leads to a violating the privacy to avoid this they solved it by providing a review through survey mainly to enhance the secure the personal information [5].To completely survey for a security and sharing image privately by the outline of new projection saving method for labeling image on long range informal destination for the communication has been advised here [6].The answer will be known that how the similar policies obtained by automatically generation of the policy on each uploaded photo so there is also a restricted to access on shared data and also how the effects on effectiveness is approached on tagging system [7].

III. System Design

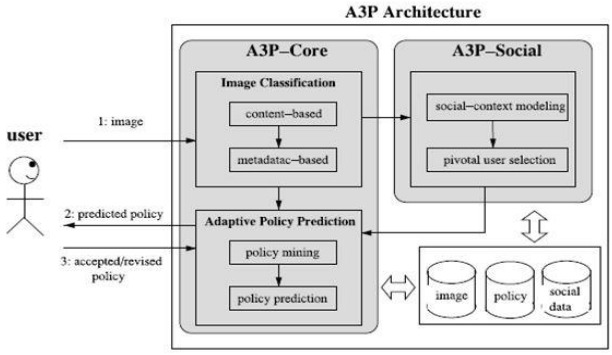


Figure: 1 Architectural Design

User will input an image if already user had earlier put some image into flicker or something. Current images features will be extracted features means color features will be extracted. They will be compared with the previous images will get a metadata. Metadata means what were the tags of previous images, what were the security of previous images this policy will be extracted from by comparing the image policy which is already stored by the user once this is been done whenever this image is published this image will be published with the predicted policy.

Tools and Technologies used

Flicker API It is a social site where we can upload, share, tag, and view the image. Here we can upload huge amount of data the photos can be shared with friends or everyone and also we can make a setting within it where some groups can be formed.

A Forge

A Forge is a real time computer vision library for .Net so the statistics class is going to return three statistics red, green and blue because every image pixel comprises of red, green and blue these three statistics we are going to add in three series of the chart one is the red value one is the green value and one is the blue value. Once it is shown in the chart

Machine Learning It is a simple learning which is similar to mining a data any data artificially can be learned in this.

K-Nearest neighbor classifier Here as its name indicates it collects the nearest value that is only the nearest neighbor will be classified. It is also known as machine learning algorithm.

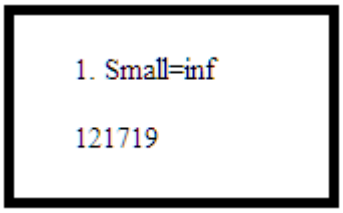
So how do we find out the nearest number what we need to do to find out the smallest number is.

First we take

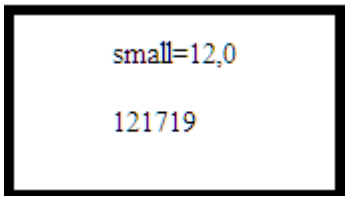
Small = inf

Suppose we have values 121719

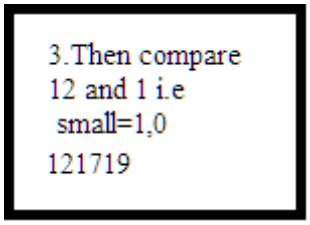
Now compare whether 12 be smaller than infinity.



If yes then now small will become 12 and index is 0.



Then compare whether 1 is smaller with 12 or not yes it is so small value become 1 index will become 1.



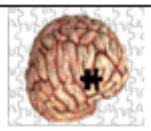
Then compare whether 7 is smaller than 1 or not
7<1, No. and
19<1, No
So at the end of the loop we will get which index has got the smallest value

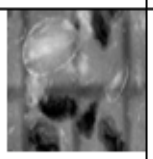
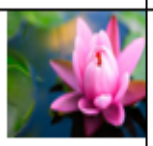
IV. METHODOLOGY:

User should create a flicker account he should create an appropriate group. He must invite other friends to different groups. The friends must join the group then he needs to run the application. In the application user should browse specific category of image put all the necessary metadata use the privacy setting and upload the image. When user uploads an image the image features that is texture, color, shape will be extracted and the metadata will be extracted it will be saved in a data base. Every time user uploads a new image that will be compared with the previously uploaded images. If any of the previously uploaded images is closure to the new image automatically the privacy setting will be changed to the privacy setting used for previously uploaded image. If the new image is completely a new image and does not have any relationship with previously uploaded image then user will be prompted for new privacy settings which will also be saved in the data base. Once the user shared the image this image should be available across the internet in the same site so other user should be able to view this image as per the privacy for example we will login to this system with one of our friends account which is already accepted our group request in flicker who is part of the news group we need to show that that user is able to see all the news related photographs and not the other photographs, for example another group which has got our friends who are part of sports group we need to log in through their account to the flicker and then you should show that they are able to see only the sports related photographs that is been shared by us.

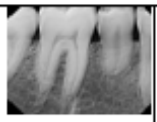
V. RESULT ANALYSIS

Image Table

Given Image	Detected	Actual	True/ False
	Public	Public	True
	Public	Public	True
	Private	Private	True
	Private	Private	True
	Private	Public	False

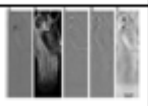
	Public	Public	True
	Public	Private	False
	Public	Public	True
	Private	Private	True
	Public	Public	True

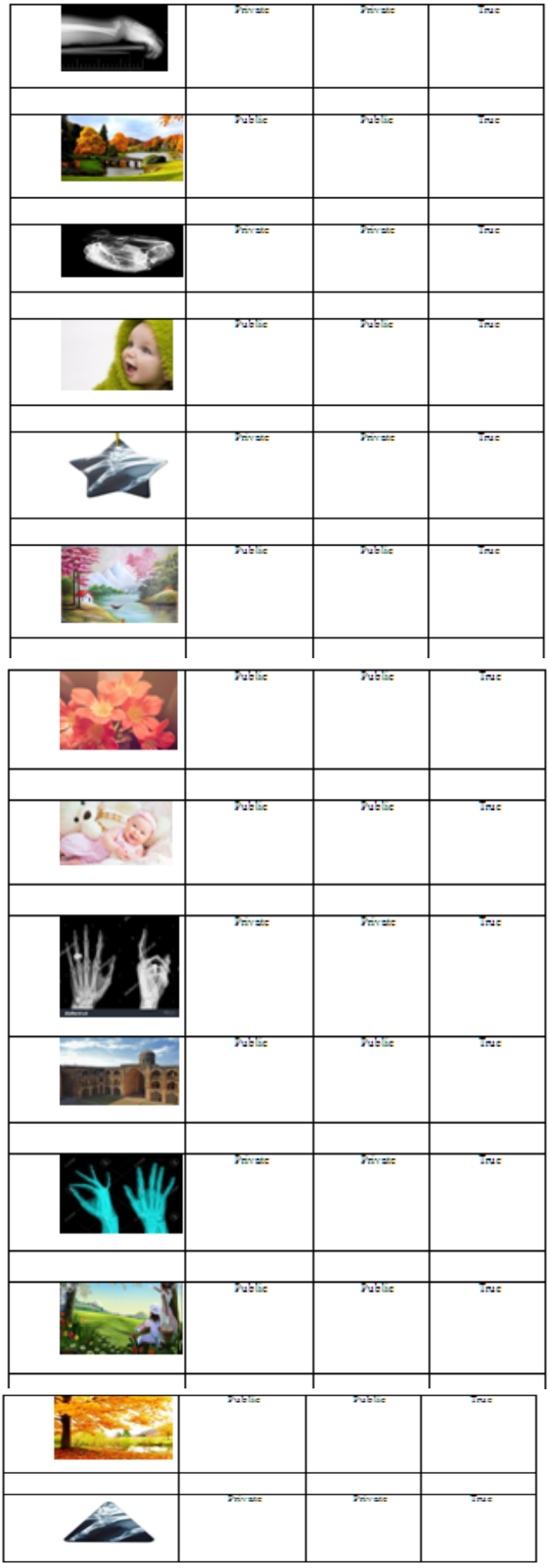
	Public	Private	False
	Private	Public	False
	Public	Public	True
	Public	Public	True
	Public	Public	True

	Private	Private	True
	Public	Public	True
	Private	Public	False
	Public	Public	True
	Private	Private	True

	Public	Public	True
	Public	Private	False
	Public	Public	True
	Public	Public	True
	Private	Private	True
	Private	Private	True

	Public	Public	True
	Public	Public	True
	Private	Private	True
	Private	Private	True
	Public	Public	True

	Public	Public	True
	Public	Private	False
	Private	Public	False
	Public	Public	True
	Private	Private	True
	Public	Public	True



The accuracy is 42/50 which is 84%

VI. Conclusion and Future Scope

With the popularity of the social networking sites every day millions of photographs have been shared in the social networking site. This increase the risk of misusage of the photographs been shared many a time user forgets to set appropriate security and privacy setting for the images that have been shared across the social site. In this world we have proposed novel mechanism to guide the user to automate the process of ensuring privacy setting for the images. The proposed technique first learns from already shared images by the user about the pattern and then classifies any new image that user intends to share in social site of flicker as either private or public result shows that the proposed system can predict the privacy setting of the images with an accuracy of over 80% therefore this can be used in a large variety of application and domain including "face book", "twitter", "Google plus" and so

This work can be further improved by replacing the K-Nearest neighbor classifier which is a primitive classifier with more advanced classifiers like neural networks further more security settings like sharable within the group sharable within the family or others could be incorporated as a future work to extend the domain of privacy settings of the images.

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